West Coast Vancouver Island Groundfish Bottom Trawl Survey, *R/V WE RICKER*, May 25 to June 10, 2004

G.D. Workman, N. Olsen, J. Fargo, and R.D. Stanley

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
V9T 6N7

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by

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Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
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V9T 6N7

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ABSTRACT

Workman G.D., Olsen, N., Fargo, J., and Stanley, R.D. 2008. West Coast Vancouver Island groundfish bottom trawl survey, R/V WE RICKER, May 25th to June 10th, 2004. Can. Manuscr. Rep. Fish. Aquat. Sci.2826: viii + 64 p.

A bottom trawl survey of the west coast of Vancouver Island was conducted on the fisheries research vessel WE RICKER between May 25th and June 10th, 2004. The survey was jointly conducted and funded by the Canadian Groundfish Research and Conservation Society (CGRCS) and Fisheries and Oceans Canada (DFO). It was the first in what is intended to be a long-term survey series, coordinated with other area-specific surveys that together cover the continental shelf and upper slope of most of the British Columbia coast. The objective of these surveys is to provide fishery-independent abundance indices of all demersal fish species available to bottom trawling, as well as to collect biological samples of selected species.

The survey conducted 90 successful tows from a total target of 106. The mean catch per successful tow was 679 kg, averaging about 20 different species of fish and invertebrates in each. The most abundant fish species encountered was spiny dogfish followed by arrowtooth flounder, Pacific ocean perch, sablefish, Dover sole, Pacific hake, lingcod and rex sole. Biological data, including individual length, weight, sex, maturity, and age structure, were collected from 52 species of fish. Oceanographic data and net geometry were also recorded for most tows, including water temperature, depth, headrope height, and wingtip spread. CTD casts were performed at 53 "La Perouse Project" sampling stations. Sea surface temperature and salinity and Doppler current profiler data were also collected throughout the survey.

RÉSUMÉ

Workman G.D., Olsen, N., Fargo, J., and Stanley, R.D. 2008. West Coast Vancouver Island groundfish bottom trawl survey, R/V WE RICKER, May 25th to June 10th, 2004. Can. Manuscr. Rep. Fish. Aquat. Sci.2826: viii + 64 p.

Du 25 mai au 10 juin 2004, la Canadian Groundfish Research and Conservation Society (CGRCS) et Pêches et Océans Canada (MPO) ont effectué conjointement et cofinancé un relevé au chalut de fond de la côte Ouest de l'île de Vancouver à bord du navire de recherche sur les pêches *W.E. RICKER*. Ce relevé est le premier de ce que l'on prévoit être une série de relevés à long terme, coordonnés à d'autres relevés propres à la région de sorte à couvrir le plateau continental et la partie supérieure du talus de la plus grande partie de la côte de la Colombie-Britannique. Ces relevés ont pour objectifs d'obtenir des indices d'abondance, indépendants de la pêche, de toutes les espèces de poissons démersaux pouvant être chalutés par le fond et de prélever des échantillons de certaines espèces.

Du nombre cible de 160 relevés, 90 ont été fructueux. Le poids moyen des prises récoltées par trait réussi s'élevait à 679 kg; en moyenne, près de 20 espèces de poissons et d'invertébrés ont été capturées à chaque trait. L'aiguillat commun était l'espèce la plus abondante, puis venaient la plie à grande bouche, le sébaste à longue mâchoire, la morue charbonnière, la limande-sole, le merlu du Pacifique, la morue-lingue et la plie royale. Des données biologiques, notamment la longueur, le poids, le sexe, le stade de maturité et la structure par âge, ont été recueillies sur 52 espèces de poissons. Des données océanographiques et des données sur la géométrie du chalut pendant la plupart des traits ont également été recueillies, y compris la température et la profondeur de l'eau, la hauteur de la ralingue supérieure et l'écart des pointes des ailes du chalut. Des mouillages de sonde CTD ont été effectués à 53 stations d'échantillonnage du Projet La Perouse. La température et la salinité de la surface de la mer et des profils des courants ont également été recueillis tout au long du relevé.

INTRODUCTION

The West Coast of Vancouver Island (WCVI, Figure 1) is a major contributor to the Canadian west coast groundfish trawl fishery with around 40000 – 140000 metric tonnes of mixed groundfish being landed from this area annually. Approximately 6000 – 9000 tonnes are taken by bottom trawl. Table 1 lists average annual catches for this area comprising 95 % of the bottom trawl catch from the WCVI by species between 1996 and 2000. This area contributes significantly to the catches of both longspine and shortspine thornyheads (*Sebastolobus altivelis and Seb. alascanus*); Dover and petrale sole (*Microstomus pacificus and Eopsetta jordani)*; canary, yellowtail and bocaccio rockfishes (*Sebastes pinniger, S. flavidus and S. paucispinis*); lingcod (*Ophiodon elongatus*) and spiny dogfish (*Squalus acanthias*). In most years 80-90 % of the Pacific hake (*Merluccius productus*) caught off the British Columbia (BC) coast is taken off the WCVI; many of the species caught as bycatch in that fishery are also taken in the bottom trawl fishery.

The Department of Fisheries and Oceans (DFO) last conducted a population indexing bottom trawl survey of the slope/shelf region off the WCVI in September 1996 (Olsen et al., 1997), prior to that the most recent survey was conducted in 1985 (Leaman et al., 1988). The US National Marine Fisheries Service (NMFS) surveyed the lower west coast of Vancouver Island as part of their triennial bottom trawl survey between 1977 and 2001. Indices from that survey have been used in a number of stock assessments including boccacio (Stanley et al., 2004), longspine thornyhead (Starr and Haigh, 2000), sablefish (*Anoplopoma fimbria*)(Haist et al., 2005), and petrale sole (Starr and Fargo, 2004). NMFS stopped surveying Canadian waters in 2001 and terminated the triennial survey program in 2004.

Sinclair et al., (2003) recommended the development of fishery independent relative abundance indices using random depth stratified bottom trawl surveys for the entire BC coast. Following those recommendations a survey was conducted in the summer of 2003 (Olsen et al., 2007a) in Queen Charlotte Sound to test methodology, evaluate survey design and develop bio-sampling protocols. Following on the success of that survey a "**Survey Strategy**" was developed (Stanley et al., in prep, Stanley et al., 2003) to provide bottom trawl survey coverage for most of the trawlable bottom available on the BC coast. As part of the strategy this survey was undertaken to evaluate the government research trawler CCGS WE RICKER, and to fill the void left by the termination of the US triennial survey.

The objectives of the survey were to:

- Collect detailed distributional and abundance data for all species available to bottom trawl gear;
- Collect detailed biological data for selected species;
- Collect environmental data at Established "La Perouse Project" time series CTD stations;
- Evaluate the WE RICKER.

This report is not intended to provide a comprehensive analysis of the data collected during the survey but rather to serve as an instrument to document procedures,

provide general results and capture meta-data from the survey. Detailed analyses of the biological and catch data collected during the survey will be the subject of separate reports.

METHODS

VESSEL

The CCGS WE RICKER (Figure 2) is a 58 m, 413 tonne, steel stern trawler with 2500 hp. It is equipped with two 15 tonne trawl winches each carrying 800 m of 28 mm fiber core main trawl warp. For a complete description of the WE RICKER go to the Canadian Coast Guard Web site at: **http://www.pacific.ccg-gcc.gc.ca/fleet-flotte/fleetinfo/wericker_e.htm**

NET AND RIGGING

In an effort to standardize survey gear we elected to use the same Atlantic Western IIa "box trawls" for this survey as had been used for the Queen Charlotte Sound survey in 2003 (Olsen et al., 2007a). These nets were recommended by commercial fishermen as reliable general purpose nets suitable for survey work due to their durability and ease of repair. Two trawls were purchased by the Canadian Groundfish Research and Conservation society (CGRCS) for survey work in 2001 and 2002, the CGRCS loaned DFO these trawls for the purposes of this survey. Details of net construction and rigging are listed in Table 2. In the event of net damage the crew was required to repair the net to its original specification before putting it back into service, broken mesh had to be repaired between tows and any missing web had to be replaced with new.

TRAWL MONITORING

SIMRAD ITI net mensuration gear was used to measure door spread, wingtip spread, headrope height, depth and temperature during most trawl sets. The ITI system consists of sensors that are attached at various locations on the net, a ram-mounted transducer that receives signals from the sensors via an acoustic link, and a deck unit that processes and displays data from the sensors. Sensor data were also recorded manually by the chief scientist on supplemental bridge log forms.

Alternatively, or in addition to the SIMRAD ITI, the net sonar ("third wire"), Furuno FS20, was used to monitor net opening and bottom contact throughout the tow. The FS20 consists of a dual head scanning sonar, which is mounted in the middle of the trawl headrope. Data is transmitted to a deck unit aboard the ship via a coaxial cable; images of the trawl are displayed on a computer monitor showing a cross section of the trawl. The width and height of the trawl was measured off the display and recorded by the chief scientist on supplemental bridge log forms.

TRAWL MOUNTED SCIENTIFIC PROBES

A Mac Marine (NMFS) bottom contact sensor (BCS) recorded net contact with the bottom at six second intervals. This device consists of a digital inclinometer, and a data logger enclosed in a heavy stainless steel housing. The sensor is hung off the foot rope on a short chain bridle and measures tilt angle with an angle of 90 degrees indicating the device is vertical and an angle of 0 degrees indicating horizontal. During net deployment the BCS records ~ 90 degrees and when on bottom records 0 – 10 degrees

indicating good contact between the footrope of the net and the bottom. The chief scientist (CS) is responsible for downloading the BCS data several times a day using a data shuttle with an infrared link to the data logger.

A SeaBird Electronics SBE 39 temperature and depth recorder was attached to the head-rope of the net and logged temperature and depth at 10-second intervals throughout the day. The SBE 39 was mounted in a two-inch PVC pipe housings for protection and attached to the head-rope using chain and karabiners The CS was responsible for downloading the data several times a day to minimize the risk of data loss if a sensor failed. Data were downloaded directly from the SBE 39 via a cable connected to the serial port of the bridge laptop using SeaBird SeaTerm software.

SURVEY DESIGN

The survey area encompasses the west coast of Vancouver Island from the Canada/US border in the south to Quatsino Sound in the north (Figure 3). The survey did not cover the area north of Topknot Island due to the scarcity of trawlable bottom. Depths surveyed ranged from 50 – 500 m; the depth stratification scheme was the same as that used in Queen Charlotte Sound in 2003 (Table 3). The survey frame did not include inlets or enclosed waters. The overall survey surface area (50-500 m) is about 12,918 km^2.

An analysis of previous survey data and commercial fishery data was undertaken to estimate the effort required to generate meaningful abundance indices for this area (Schnute and Haigh, 2003). It was determined that 180-190 tows would be required to generate high precision indices (CV < 0.2) for up to 20 species. Unfortunately, due to vessel scheduling conflicts, only two and a half weeks were available so it was decided to treat this survey as a "pilot" to evaluate the vessel, gear and survey design.

Experienced fishermen were consulted prior to the start of the survey to identify un-trawlable areas. Several prominent bathymetric features were identified, however, given the random distribution of survey sites and the short tow durations, no areas were rejected from the survey frame. All selected survey blocks were to be inspected on the grounds prior to being fished or rejected.

TIMING

Sinclair et al. (2003) noted distinct seasonal patterns in depth distribution with most species occupying shallower feeding grounds in the summer and deeper spawning grounds in the winter. Both the duration and timing of the spring and fall transition periods, when fish are moving between grounds, is variable but most species finish their spring transition by the end of June and do not start the fall transition until October. Thus, surveys should be undertaken between July 1 and September 30. Timing for this survey was set by the vessel schedule. While not optimal, an evaluation of season depth distributions showed a high degree of inter-annual variation with many species completing their transitions by early June (Figure 4).

BLOCK SELECTION AND SURVEY MANAGEMENT

Initially a grid of 4 km^2 (2 km x 2 km) blocks was superimposed on a digital bathymetric model of the survey area. The average depth was computed for each block and stratum membership assigned. Blocks were then selected at random within strata

based on the allocation scheme. Blocks that fell within rockfish conservation areas (RCAs) or enclosed waters, were eliminated from the initial set. A geographic information system (GIS, ArcMap 8.0) was used to design and then manage the survey.

Prior to departure a set of 99 primary blocks was selected at random based on the allocation scheme outlined in Table 4 (initial allocation). Given the linear nature of the west coast of Vancouver Island the survey proceeded from south to north assessing and/or fishing every block in the initial set. Once the northern extent of the survey frame was reached the average number of blocks completed each day was computed and multiplied by the number of remaining survey days to estimate the number of blocks that could be completed in the remaining time. This resulted in a secondary selection of 31 randomly chosen blocks which were then completed during the return southward leg.

FISHING OPERATIONS

Fishing operations were similar to those described by Olsen et al. (2007a,b,c) although there were subtle differences due to the use of a government research vessel. Details are provided to facilitate comparison with the charter vessel based surveys. Fishing commenced at 07:00 and stopped no later than 20:00 in accordance with the vessels lay-day schedule. Catch processing and biological sampling often continued for up to two hours after fishing ended resulting in an average 14 hour work day for the science crew aboard the vessel.

Each evening, after fishing had stopped, the fishing master and chief scientist would review a map of the remaining blocks and select which blocks would be examined the following day. Sets were selected to minimize running time between stations, mix the anticipated catch levels throughout the day, and end near one of the evening CTD stations. If in the opinion of the fishing master or a consultant fisherman a block was un-fishable it was rejected.

If the selected survey block was known to be fishable by either the fishing master or consultant fisherman we would commence fishing immediately upon arrival at the location. If unfamiliar to either, the block was inspected using the depth sounder. Inspections were in general half an hour to one hour in duration and consisted of crossing the block several times while examining the depth sounder trace looking for a section of trawlable bottom. If no tow location could be found, the block was rejected. Our intent was to minimize risk to the trawl gear and sensors.

Target tow duration was 20 minutes on bottom. Start and end times for each tow were determined by monitoring the net mensuration sensor outputs. Once the head rope height had collapsed to 3-4 m and there was no clearance to bottom indicated we concluded that the gear had "settled", was fishing, and started the tow timer. After 19 minutes of bottom time the fishing master was directed to start retrieving the net, due to "lift off lag" this generally resulted in about a 20 minute tow.

Target tow speed was 2.8 knots (5.2 km/h) over the ground throughout the survey. This is the average tow speed reported by fishers for this particular net and footrope combination.

The scope ratio used (ratio of trawl warp length to depth) was at the discretion of the fishing master. By giving him this option he was able to "short wire" (use a lower

scope ratio) when fishing rough or hard bottom. This resulted in successful fishing at several blocks we might otherwise have rejected.

Tows would be classified as usable if they met three criteria;

- minimum of 15 minutes of good bottom contact;
- during daylight hours;
- at least half the tow had to be inside the selected survey block.

In general, if the net hung up during a tow it would be classified as unusable, however, if the net was retrieved quickly, without significant damage and had a minimum 15 minutes of bottom contact, the tow could be considered usable as long as the chief scientist and fishing master agreed.

CREW AND ITINERARY

Science compliment and itinerary are presented Table 5 and Table 6 respectively. The vessel departed Nanaimo on May 25th; disembarked two science crew members on June 2; and returned to Nanaimo June 10th. Science compliment was 10 for the first leg and 8 for the second. Included in the science compliment was a consultant fisherman hired by the commercial fishing sector to provide advice to the fishing master during the survey and provide feedback to industry members on the operations of the survey.

BRIDGE LOGGING

Throughout the survey the Chief Scientist and the mate on watch were jointly responsible for maintaining a record of all significant events occurring aboard the vessel. This not only included collecting data relevant to the survey but also keeping a record of any injuries, equipment problems, gear failures or damage, personnel issues, an itinerary of ports of call, and staffing changes. For every bottom trawl tow the chief scientist completed a groundfish "Bridge log" data form recording the tow and block numbers as well as detailed time, location, depth, environmental data and whether or not the tow was usable.

In addition to the paper record, a continuous electronic record of the ships position was logged by a laptop connected to the ships GPS, a second electronic record of each trawl track was recorded by the fishing master on the ships computer using Nobeltec™ version 6.0 navigation software.

CATCH PROCESSING

At the end of each tow, the net was retrieved and the catch dumped into a hopper in the fish processing lab. Catch was sorted by species into separate baskets as it moved along a conveyor system. Catches in excess of 2000 kg were sub-sampled for species composition by selecting 5 baskets from the beginning, middle and end of the catch and weighing the rest of the unsorted catch in baskets. Baskets in the sub-sample were then dumped onto the conveyor and sorted to species; species proportions in the sub-sample were then applied to the unsorted catch weight. Several large conspicuous species (lingcod, halibut, skate, or pacific cod) were removed completely from these larger catches. This made it crucial to record the catch sorting method for each species to ensure they were not included in the calculation of species proportions for the unsorted catch.

Baskets were weighed to the nearest 0.1 kg using a large capacity, motion-compensating electronic balance (Marel Model M1100/M2000, 60 kg capacity). Weights were recorded on standard groundfish catch composition forms. Disposition of each basket of catch was also recorded on the catch composition form to provide cross validation of sampled species. Small catches were on occasion weighed using a smaller top - loading motion compensating balance (Marel Model 2200, 6 kg capacity). For small catches the number of individuals was often recorded as well as the weight.

Catch was sorted to lowest taxon possible. For most fishes this was to the level of species; invertebrates, however, were often only keyed to phylum or order. For fish, "**Fishes of Alaska**" by Mecklenburg, Mecklenburg and Thorsteinson was the principle reference for identification and taxonomy.

Catch from unusable tows was sorted but not biologically sampled.

BIOLOGICAL SAMPLING

Baskets were selected for biological sampling opportunistically in proportion to the catch; with dominant species being selected more often. Although a fixed selection protocol was not in place several species were preferentially sampled including several species of rockfish, skates, Pacific cod, and lingcod, see Table 7 for details. Three distinct types of biological samples were collected: 1) length frequency or 2) length frequency by sex, and 3) complete biological sampling including length, sex, maturity, weight and collection of an age structure.

Length and length/sex samples were collected using tally strips recorded to the nearest centimetre. Counts at length (and sex) were then transcribed to groundfish length frequency data forms; sample weights (by sex) were also recorded.

During complete biological sampling, length was determined to the nearest millimetre, weight to the nearest gram, and maturity to the nearest stage as defined in Appendix 1. Data for each specimen was recorded on standard "Card 04 – Biological Sampling" forms. Otoliths were collected for ageing rockfish and flatfish, second dorsal fin rays for lingcod and Pacific cod and right pectoral fins for pollock. Otoliths were cleaned and stored in "Tray Bien" otolith trays in a 50:50 solution of glycerine/water with 1 g thymol added per litre. For lingcod, rays 4 -10 of the second dorsal fin were collected, for Pacific cod the first 10 rays of the second dorsal fin, and for walleye pollock the entire right pectoral fin. Fins were collected in labelled coin envelopes with the meaty part of the fin projecting. Envelopes from the same sample were bundled together and stored frozen until dried for processing.

OCEANOGRAPHIC DATA

Throughout the survey, CTD (Conductivity, Temperature and Depth) casts were performed at established "La Perouse Project" stations during the night. Once fishing operations ended the vessel would immediately proceed to the nearest CTD transect line and commence CTD casts. In general one transect was completed per night. Casts were performed using a SeaBird SBE 911 guild-line CTD.

A captive thermosalinograph (SeaBird SBE 21) installed in the hull of the WE RICKER recorded continuous position, sea surface temperature and salinity data

throughout the survey. An ADCP (Acoustic Doppler Current Profiler) ran continuously throughout the survey as well.

BIOMASS INDEX

The biomass index of fish species captured in the survey was obtained by multiplying the mean catch density per stratum by the area in each stratum and summing over all strata:

$$B = \sum_{i=1}^{k} C_i A_i = \sum_{i=1}^{k} B_i$$

where C_i = mean catch density (kg/km^2) for species s in stratum i.
A_i = area of stratum i (km^2).
B_i = biomass of species s in stratum i.
k = number of strata.

The mean catch density (C_i) in each stratum was calculated by:

$$C_i = \frac{\sum_{j=1}^{n_i} \left(W_j / D_j w_j \right)}{n_i}$$

where W_j = catch weight (kg) of tow j in stratum i.
D_j = length (km) of tow j in stratum i.
w_j = mean net width (doorspread; km) of tow j in stratum i.
n_i = number of tows in stratum i.

One thousand bootstrap replicates with replacement were performed on the survey data to estimate bias corrected 95% confidence limits and relative error for each biomass estimate, with relative error defined as the coefficient of variation (CV) of the distribution of the 1000 boot strapped estimates.

RESULTS

VESSEL SUITABILITY

One of the primary objectives of the survey was to assess the WE RICKER's suitability for conducting large scale bottom trawl surveys. Given its long history as a commercial and research trawler, the ship's trawl capability was not in question, the real issues were: 1) would the vessel be as productive as a chartered commercial vessel given that the hours of operation are constrained by the crew's hours of work; 2) would there be too much catch given the size of net being used and the size of the fish processing lab; and 3) how much marketable fish would be discarded due to the inability to retain catch for sale. Surprisingly, in terms of the number of tows per day the WE RICKER is as productive as a chartered commercial vessel completing on average 6.7 tows per day.

Olsen et al., (2007b) report an average 6.9 successful tows per fishing day aboard a chartered commercial fishing vessel fishing considerably longer days. Reasons for this include: 1) the larger deck allowing the crew to dump the catch and clean the net very efficiently between tows; 2) the catch being processed below decks allowing the net to be reset without having to wait for the tow to be sorted; and 3) the layout of the fish hopper and processing lab allowing several tows to be stockpiled for evening processing by the science crew after the ship's deck crew had finished for the day. There were no catches that were too large to fit in the below deck fish hopper meaning catch quantity was not an issue for the vessel in this area during this survey. Of the total catch of 63,894 kg, slightly less than half, 29,139 kg, was comprised of marketable sizes of marketable species. Of this a significant portion, 10,075 kg, was biologically sampled.

FISHING OPERATIONS

From a total of 17 vessel days, 3 days were required for travel to and from the grounds, an additional half day was lost to a science crew change (Table 5). No days were lost due to weather or equipment failures (Table 6). This resulted in 13.5 days of actual fishing time during which a total of 106 trawl sets were made. Of these, 90 were successful, 3 were not survey sets (67, 68, 73) and 13 failed. This resulted in an average of 6.7 successful tows per fishing day.

In total 130 survey blocks were either fished or inspected. Table 4 summarizes the results by selection and final status. Twenty two blocks were rejected on the basis of prior knowledge, 6 were rejected after an on grounds inspection, and 11 were rejected after failed fishing attempts. Eighty eight blocks were fished successfully on the first attempt, while 2 blocks were fished successfully after a second attempt. This resulted in a final status of 90 successfully fished survey blocks and 40 rejected blocks. Figure 3 shows the final status of survey blocks.

Figure 5 shows a plot of survey blocks off the entrance to Barkley Sound with the trawl track lines from each tow overlain. Red blocks with no trawl track in them were rejected on the basis of prior knowledge or an inspection. Set 91 is an example of a block that was rejected after a failed fishing attempt. All green blocks were fished successfully after one (sets 14,16,17) or more (sets 98, 99) attempts. In this plot there are several blocks that were classified as successful (Usable) even though half the trawl track was not within the block. By the rules outlined above these blocks should have been rejected. However, one must be somewhat pragmatic given the limited vessel and personnel resources available, so following each tow the chief scientist and fishing master would determine the reason(s) for the tow occurring outside the block, and if it could be clearly determined that either current, weather, or a misjudgment in timing was the cause, the tow was retained as usable. The intent behind the requirement for tows to be half within a block was to minimize the opportunity for chartered commercial fishers to increase their catches by moving tows to slightly fishier locations outside of the target block. Commercial fishers might be motivated to do so for several reasons including: competition with other commercial fishers; having a desire to show the scientists where the fish are; or force of habit. Because we were using a government vessel instead of a charted commercial vessel most of these potential biases disappeared with the possible exception of competition thus, each tow's usability was assigned in the field after discussion with the fishing master.

Appendix 2 lists details for each trawl tow including time, position, depth, duration, speed, length of main warp deployed, direction of the set, identifier, total catch weight and whether or not the tow was usable.

Significant gear damage occurred during the first few days of the survey in the deeper waters off south-western Vancouver Island. This area is known to have high relief bathymetry, is an area of discarded armaments and has a large number of abandoned and active submarine cables. Future surveys will not revisit blocks where the net hung up or sustained damage.

CATCH

A total of 63,894 kg of mixed fish and invertebrates were caught during the survey. By species group the catch was divided almost equally among flatfish, rockfish, cartilaginous fish and roundfish with each accounting for 30, 28, 23 and 19 % of the catch respectively (Table 8). Seventy five percent of the catch by weight was comprised of the following eight species: spiny dogfish, arrowtooth flounder, Pacific ocean perch, sablefish, Dover sole, Pacific hake, lingcod and rex sole (Table 9). The most common species were rex sole and spotted ratfish occurring in 87 of 106 tows. The largest inveterate catch by weight was gonate schoolmaster squid, and fragile urchin was the most frequently encountered. Species catches by tow are presented in Appendix 3.

Mean catch weight per usable tows was 679 kg, while median catch weight was 418 kg. Five percent of tows caught less than 50 kg, 17 % of tows were larger than 1,000 kg, and 79 % of tows weighed between 50 and 1,000 kg (Figure 6).

On average 20 species were recorded per tow with a maximum of 43. Of 166 unique identifications made in the field 132 of these are to the level of genus and species (Appendix 4). Ninety five fish species were identified (Table 8) including 28 rockfish, 15 flatfish, and 6 elasmobranches. Sixty five invertebrate species groups were identified. Invertebrates were recoded from 93 of 106 sets, averaging 3 species per tow with a maximum of 18.

Maps of catch for the dominant species encountered are presented in Figure 7 to Figure 14. The circles are scaled to the total catch weight, and all species are presented on the same scale.

BIOMASS INDICES

Biomass indices have been generated for the 40 most abundant species encountered and are presented in Table 9. When interpreting these indices it is important to remember that they are relative and are being presented here to facilitate comparisons between survey areas and survey years. These indices should not be interpreted as estimates of population biomass because the numbers can be changed dramatically by changing either the estimate of habitat area or the method used to determine the area swept by the trawl.

Area swept is determined by multiplying the effective path width of the net by the distance towed. Effective path width is in fact, a pragmatic choice, it is the distance between the trawl doors, the distance between the wingtips of the net or possibly something in between like the distance between the leading ends of the lower bridle. If

you believe the species for which you are computing a biomass index is effectively herded by the sweep wires or bridles your preference would be to use door or bridle spread, if on the other hand you believe no herding takes place then you'd simply use the wingtip spread. The standardized approach to all species taken here is to use trawl door spread as the effective path width. Unfortunately during this survey we were unable to measure door spread so we used the mean door spread observed for this net, rigging and vessel in a subsequent year as the path width (2006 survey, Workman et al., in prep). Distance towed was determined in one of two ways. For tows with available bottom contact data we used the start and end bottom contact times to determine start and end positions in the GPS track line data and integrated the distances between all observed positions during the tow. For tows without bottom contact data we used the mean vessel speed during the tow and tow duration to calculate distance towed.

The second part of computing a biomass index is the estimate of habitat area. As stated earlier in the report, habitat area was computed using a GIS and included all the area of each depth stratum within the survey area excluding only enclosed waters and rockfish conservation areas. It is likely that this grossly overestimates the true habitat for a given species due to each species preference for a particular substrate and topography, after all a sole is unlikely to live on a rocky reef and a rockfish is unlikely to be found on a flat sandy bottom. Future indices might be computed using more complex species specific estimates of habitat derived from habitat models that incorporate factors such as substrate type, relative slope, hardness, currents or water properties (oxygen, pH). Until these become available the generalized estimates derived here will be used.

Species with the highest biomass indices were: spiny dogfish, arrowtooth flounder, Pacific ocean perch, sablefish and Dover sole. Species with the most precise indices, or lowest relative error, included rex sole, Dover sole, longnose skate, slender sole and shortspine thornyhead. With 90 usable tows, only 5 species achieved the target relative error of less than 0.2, 8 species were between 0.2 and 0.3, and another 18 species fell between 0.3 and 0.5. One of the design objectives of this series of surveys is for each area specific survey to generate 20 or more biomass indices with a relative error of less than 0.2. Future surveys will require significantly more tows to achieve this.

BIOLOGICAL DATA

A total of 805 samples comprising 22,480 specimens across 52 species were sampled, and 5,819 ageing structures were collected from 35 species. Table 10 catalogues the attributes collected by species, Table 11 lists the sample types by species and Table 12 summarizes length, weight and sex proportions by species. With the exception of species which were sampled from every tow in which they occurred (Pacific cod) the species most frequently sampled were those most frequently encountered in the catch (arrowtooth flounder, spiny dogfish, Dover sole).

GEAR PERFORMANCE DATA

Table 13 lists vessel, environmental and gear performance data collected during the survey. Global positioning system (GPS) latitude and longitude were recorded during every tow. Seabird SBE 39 temperature and depth data were recorded for 89 sets while bottom contact data is available for 68 sets. An example SBE 39 temperature depth profile for set 56 is presented in Figure 15. Bottom contact data are only available for 68

sets due to the sensor fouling in the chain bridle used to mount it on the footrope. The sensor would roll through the bridle so that it was riding upside down on the bottom generating no usable data. The issue was resolved by remounting the sensor bridle with very wide attachment points such that the bridle formed roughly a 70 – 80 degree angle where it attached to the front of the sensor. The wide attachment points prevented the sensor from rolling over while in use and careful deployment prevented it from flipping through the bridle. Two example bottom contact traces from the NMFS BCS are presented; Figure 16 shows a trace while fishing on smooth mud or sand bottom during set 56 while Figure 17 shows a trace for set 77 on rougher bottom.

Mean vessel speed while fishing (during usable sets) ranged from 4.15 km/h to 6.31 km/h, with a mean of 5.24 km/h.

SIMRAD ITI and FURUNO FS20 data on net height and wing tip width were recorded manually throughout the survey. The door spread sensors failed early in the survey consequently, door spread data is not available. Mean net width was 10.1 m (7.9 – 11.8 m) measured using the FS 20 and 14.4 m (9.0 – 16.7 m) using the Simrad ITI. Simrad ITI sensors measure the wingtip to wingtip distance while the FS20 headrope sounder measures the cross section of the net at the centre of the headrope which due to the curvature of the net while fishing will be some distance behind the wingtips. Net height averaged 4.8 and 4.4 m respectively. The close correspondence of values between these two sensors is due to their proximity on the net (Figure 18). The FS 20 or third wire net sonar was used as a backup to, and to cross validate the data generated by, the SIMRAD ITI system during this survey. Due to concerns over the downward herding effect of the third wire and its possible impact on catch rates for some species this device will not be used during future WCVI bottom trawl surveys.

The relationship between warp length and bottom depth is plotted in Figure 19. The scope ratio ranged from 1.6 to 3.1 with a mean of 2.2. In general the scope ratio selected by the fishing master decreased as depth increased (Figure 20) although on many occasions when the bottom topography was rough a lower scope ratio was used to reduce the likelihood of hanging up. As depth increased variability in scope ratio decreased, note in Figure 21 the wide range of scope ratios employed in relatively shallow depths.

Appendix 5 lists mean sensor data by set.

OCEANOGRAPHIC DATA

CTD casts were performed at 53 established "La Perouse Project" stations (Figure 22). CTD data have been processed by staff at the Institute of Ocean Sciences, Sidney BC, and added to the oceanographic data archive (Mr Robin Brown, Custodian). Captive thermosalinograph data have been incorporated into the groundfish surveys database and the ADCP data has been deposited with Dr. John Holmes of the Applied Technologies section at the Pacific Biological Station.

RECOMENDATIONS

- During future WCVI surveys the number of usable tows must be increased to about 170 to develop adequately precise abundance indices for most of the major commercial species.
- The depth range for this survey must be increased to at least 1200 m to be representative of the commercial fishery in this area. Currently the survey design only covers 50 to 500 m depth and misses a significant portion of the fishing grounds.
- Given the level of gear damage sustained during this survey more effort needs to be spent identifying un-trawlable areas and eliminating these from the survey frame, this will also make survey operation significantly more efficient allowing a greater number of successful tows to be completed during the allotted time.
- Future surveys should continue to include a consultant fisherman as part of the science compliment.

ACKNOWLEDGEMENTS

The officers and crew of the WE RICKER are to be commended for their service during this survey. Fishing and oceanographic vessel handling was accurate and timely, fishing gear was handled in a professional manner and repairs were made quickly; the engineering staff ensured all vessels systems were operational and addressed defects in a timely manner, the galley staff ensured all science crew were comfortable and their personal needs addressed. The Canadian Groundfish Research and Conservation Society, in particular Mr Bruce Turris, was very helpful in providing the trawl nets for the survey, and two fishermen, Captain Brian Dickens and Captain Brian Mose reviewed the survey design and provided input on the trawlability of specific areas. Mrs. Karina Cooke must be thanked for her thorough reviewed the transcript.

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TABLES

Table 1: Mean annual observed bottom trawl catch coastwide and for the west coast of Vancouver Island (retained + discarded) in metric tones, as well as the proportion of the coastwide catch which is taken off the WCVI. Listed are the 27 species which comprise 95 % of the catch off the WCVI.

Common Name	Coast wide	WCVI	Proportion of coast wide catch
Arrowtooth flounder	8611	3436	40%
Dover sole	3060	1351	44%
Yellowtail rockfish	1982	859	43%
Lingcod	1552	705	45%
Spiny dogfish	1294	651	50%
Longspine thornyhead	672	580	86%
Pacific ocean perch	5752	503	9%
Canary rockfish	714	425	60%
Pacific hake	514	398	77%
Sablefish	657	392	60%
Shortspine thornyhead	616	349	57%
Petrale sole	445	252	57%
Redstripe rockfish	883	231	26%
Silvergray rockfish	1139	229	20%
Yellowmouth rockfish	2047	216	11%
Pacific cod	972	203	21%
Rougheye rockfish	561	141	25%
Rex sole	589	131	22%
Sharpchin rockfish	370	128	35%
Longnose skate	314	123	39%
Grenadiers	152	96	63%
Pacific halibut	474	94	20%
Spotted ratfish	724	93	13%
English sole	958	80	8%
Tanner crabs	83	79	95%
Bocaccio	175	57	33%
Widow rockfish	242	52	21%

Table 2: Specifications for the Atlantic Western IIa trawl net used as the primary survey trawl throughout the 2004 west coast Vancouver Island groundfish bottom trawl survey.

Part		Material
Rigging		
Doors	1135 kg each	USA Jet Model P
Door Legs	30'	3/4' chain
Pickups	45'	7/8' cable
Sweep Line	90'	7/8' cable
Upper bridle	90'	3/4' cable
Lower bridle	90'	7/8'cable
Net frame		
Headline	74' 6"	5/8 cable
Headline floats	90	8" plastic Spheres
Riblines	21' 6"	1" Polysteel rope
Bolsch Line	68' 4"	9/8" poly steel rope
Fishing Line	107' 4"	14 mm long link chain
Wing lines	22' 3"	14 mm long link chain
Foot Rope		
Foot Rope	107' 4"	5/8 Chain
Bosom section	14'	18 in tires spaced 6" on center
Bunt Section	18'	18" rock hopper, 18" disks spaced 21" apart
Wing Section	8' 8"	18" rock hopper, 18" disks spaced 21" apart
Wing Extension	19' 6"	5" packed rubber disks with 18" half egg at front
Web		
Flying Wing, Wing	5"	3.5 mm Euroline premium
Square	5"	3.5 mm Euroline premium
Bunt wing	5""	3.5 mm Euroline premium
Bellies	4.5"	3.5 mm Euroline premium
Intermediate	4.5"	4.5 mm Euroline premium
Guard Mesh	4.5 or 5"	Double 4.5 mm Euroline premium
Codend	4.5"	4 mm orange polyethylene
Liner	3/4"	Notless Nylon

Table 3: Survey strata depth ranges and estimated area of each for the WCVI.

Depth Stratum		Area
Meters	Fathoms	(km^2)
50 – 125	27 - 68	7,012
125 - 200	68 - 109	4,313
200 - 330	109 - 164	804
330 - 500	164 - 273	789
		12,918

Table 4: Target number of tows by stratum and success at each primary or alternate block.

Depth	Initial	Primary		Secondary		Total	
Stratum (m)	Allocation	Success	Fail	Success	Fail	Success	Fail
50 – 125	43	29	14	9	2	38	16
125 - 200	39	26	13	7	2	34	14
200 - 330	9	6	3	5	1	11	4
330 - 500	8	4	4	4	1	8	5
Grand Total	99	65	34	25	6	90	40

Table 5: Staffing and leg durations for each leg of the 2004 WCVI survey.

Leg	Dates	Person	Affiliation
1	May 25 to June 2	Dave Wensley	DFO-CCG-Captain
		Brian West	DFO-CCG-Fishing master
		*Jeff Fargo	DFO –PBS
		Greg Workman	DFO –PBS
		Rob Kronlund	DFO –PBS
		Malcolm Wyeth	DFO –PBS
		Kate Rutherford	DFO –PBS
		Ed Choromanski	DFO –PBS
		Wendy Mitton	DFO –PBS
		Paul Winchell	Contractor
		Gary Sigmund	CGRCS
		Alex Peden	RBCM - Retired
2	June 2 to June 10	Dave Wensley	DFO-CCG-Captain
		Brian West	DFO-CCG-Fishing master
		*Greg Workman	DFO –PBS
		Malcolm Wyeth	DFO –PBS
		Rob Kronlund	DFO –PBS
		Kate Rutherford	DFO –PBS
		Ed Choromanski	DFO –PBS
		Paul Winchell	Contractor
		Gary Sigmund	CGRCS
		Alex Peden	RBCM - Retired

* Chief scientist

Table 6: Summary of survey operations and itinerary.

Start: Depart PBS	May 25
End: Offload PBS	June 10
Fishing days	13.5
Travel (begin and end)	3.5
Weather days	0
Breakdown	0
Total days	17
Keeper tows	90
Unusable tows	16
Inspected un-fished blocks	28
Tows per day overall	5.3
Usable tows per fishing day	6.7
Mean catch per keeper tow	679
Mean species per keeper tow	20

Table 7: Biosample protocol for selected species.

Species	Rule
Pacific Cod	Length stratified L/S/W/second dorsal fin, one fish per cm by sex. Remaining Pacific cod, up to 200 total sample size, sampled for L/S/W.
Lingcod	All lingcod > 30 cm sampled for L/S/M/W/second dorsal fin
Bocaccio	Total catch L/S/M/W/O, max. 100 per set.
Shortraker Rockfish	Total catch L/S/M/W/O, max. 100 per set.
Quillback rockfish	Total catch L/S/M/W/O, max. 100 per set.
Yelloweye rockfish	Total catch L/S/M/W/O, max. 100 per set.
Copper rockfish	Total catch L/S/M/W/O, max. 100 per set.
Redbanded rockfish	If catch > 5 pieces, Total catch L/S/M/W/O, max. 100 per set.
Petrale sole	Total catch L/S/M/W/O, max. 100 per set.
Rock sole	Total catch L/S/M/W/O, max. 100 per set.
All Skates	Total catch L/S

Table 8: Catch by species group

Species Category	Number of Taxa	Weight (Kg)
All Fish	97	63,894
Rockfish	28	17,621
Flatfish	15	19,120
Roundfish	11	12,005
Cartilaginous fish	6	14,457
Other fish	37	691
Invertebrates	65	193

Table 9: Catch by species for the dominant 40 species in the catch. Frequency of occurrence, total catch weight and maximum and mean per-tow catch weight, the relative abundance index and its coefficient of variation from bootstrapped area expansion estimates.

Species	Number of Tows	Catch Weight (kg) Total	Maximum	Mean	Relative Biomass	CV
Spiny dogfish	74	12,572.2	3,726.0	169.9	14345	0.35
Arrowtooth flounder	77	10,287.4	1,740.4	133.6	7366	0.24
Pacific ocean perch	36	9,357.6	3,770.8	283.6	4167	0.33
Sablefish	64	5,899.8	1,836.8	92.2	3510	0.29
Dover sole	83	2,900.3	170.6	34.9	2660	0.14
Pacific hake	46	2,436.4	447.7	54.1	2481	0.30
Lingcod	47	2,199.3	1,050.7	46.8	2206	0.48
Rex sole	87	2,106.3	150.1	24.2	1905	0.11
Splitnose rockfish	19	1,427.7	944.4	79.3	620	0.63
English sole	63	1,218.7	193.5	19.3	1602	0.26
Redstripe rockfish	21	1,060.4	417.9	53.0	745	0.53
Pacific cod	63	980.9	113.3	16.6	1036	0.20
Spotted ratfish	87	975.4	163.8	11.3	1104	0.25
Yellowtail rockfish	43	853.0	134.9	19.8	658	0.25
Pacific sanddab	41	755.9	120.2	18.4	1031	0.24
Canary rockfish	45	753.7	215.7	16.7	715	0.31
Sharpchin rockfish	33	748.0	194.3	24.1	388	0.31
Pacific halibut	35	701.3	205.4	20.0	870	0.35
Longnose skate	55	689.1	48.2	12.5	618	0.15
Silvergray rockfish	24	685.9	235.8	28.6	533	0.38
Eulachon	24	599.8	570.6	42.8	811	0.97
Walleye pollock	22	453.1	281.7	21.6	597	0.69
Shortspine thornyhead	22	449.6	81.4	21.4	302	0.19
Rougheye rockfish	17	440.7	202.3	27.5	241	0.45
Redbanded rockfish	29	385.7	84.3	13.3	217	0.32
Bocaccio	13	357.2	242.7	27.5	304	0.65
Flathead sole	45	326.1	87.8	7.2	369	0.34
Petrale sole	54	313.1	73.5	5.8	351	0.31
Greenstriped rockfish	47	268.0	48.9	6.2	247	0.31
Southern rock sole	30	252.0	41.4	8.4	354	0.22
Yelloweye rockfish	14	241.9	72.5	17.3	244	0.42
Slender sole	63	207.2	15.1	3.4	199	0.16
Big skate	14	200.6	47.3	14.3	291	0.35
Darkblotched rockfish	15	141.3	68.9	9.4	90	0.56
Pygmy rockfish	6	108.4	105.8	21.7	3	0.63
Rosethorn rockfish	22	87.5	40.7	4.2	80	0.59
Shortraker rockfish	7	67.3	32.1	9.6	55	0.39
Yellowmouth rockfish	2	66.5	48.1	33.3	30	0.68
Quillback rockfish	10	63.1	19.6	6.3	65	0.49
Curlfin sole	13	44.1	11.2	3.4	64	0.32

Table 10: Number of samples and recorded biological attributes per species sampled.

Species	Samples	Lengths	Weights	Sexes	Maturities	Ages
Arrowtooth flounder	38	1,463	275	1,462	275	275
Big skate	14	19	0	19	0	0
Bocaccio	13	88	88	88	88	88
Canary rockfish	14	251	231	251	231	231
Chinook salmon	3	3	3	3	3	4
Curlfin sole	4	60	7	60	7	7
Darkblotched rockfish	8	115	111	115	111	111
Dover sole	56	2,663	463	2,663	463	463
English sole	36	1,626	304	1,626	304	305
Eulachon	1	153	0	0	0	0
Flathead sole	9	354	92	354	92	92
Greenstriped rockfish	13	360	140	360	140	140
Kelp greenling	3	26	0	26	0	0
Lingcod	45	331	331	331	331	331
Longnose skate	51	155	0	155	0	0
Longspine thornyhead	1	96	0	96	0	0
Pacific cod	59	731	731	731	731	598
Pacific hake	12	595	47	595	47	47
Pacific halibut	34	116	0	116	0	0
Pacific herring	2	5	0	0	0	0
Pacific ocean perch	15	691	421	691	421	421
Pacific sand lance	1	2	0	0	0	0
Pacific sanddab	18	1,442	75	1,442	75	75
Pacific sardine	1	64	0	0	0	0
Petrale sole	54	412	412	412	412	412
Puget sound rockfish	1	29	0	0	0	0
Pygmy rockfish	1	25	25	25	25	25
Quillback rockfish	8	55	44	55	44	44
Redbanded rockfish	22	254	243	254	243	243
Redstripe rockfish	12	371	71	371	71	71
Rex sole	42	2,807	147	2,807	147	147
Rosethorn rockfish	5	91	89	91	89	89
Rougheye rockfish	5	131	131	131	131	131
Sablefish	22	536	376	536	376	375
Sandpaper skate	10	11	0	11	0	0
Sharpchin rockfish	11	508	102	490	102	102
Shortraker rockfish	6	10	10	10	10	10
Shortspine thornyhead	15	769	165	769	165	165
Silvergray rockfish	10	120	72	120	72	72
Slender sole	13	614	40	614	40	40
Southern rock sole	19	748	257	748	257	257
Spiny dogfish	35	1,497	0	1,470	0	0
Splitnose rockfish	8	506	189	506	189	189
Spotted ratfish	17	699	0	699	0	0
Starry flounder	1	1	0	1	0	0
Stripetail rockfish	3	47	47	47	47	47
Sturgeon poacher	1	2	0	0	0	0
Walleye pollock	8	404	0	404	0	0
Whitebait smelt	1	81	0	0	0	0
Yelloweye rockfish	13	65	65	65	65	65
Yellowmouth rockfish	1	26	26	26	26	26
Yellowtail rockfish	10	252	121	252	121	121
Total	805	22,480	5,951	22,098	5,951	5,819

Table 11: Number of samples and specimen by sample type for sampled species.

	Total		Len/Sex		Len/Sex/Wt/Age	
Species	N	n	N	n	N	n
Arrowtooth flounder	38	1,463	29	1,188	9	275
Big skate	14	19	14	19	0	0
Bocaccio	13	88	0	0	13	88
Canary rockfish	14	251	3	20	11	231
Chinook salmon	3	3	0	0	3	4
Curlfin sole	4	60	3	53	1	7
Darkblotched rockfish	8	115	1	4	7	111
Dover sole	56	2,663	44	2,200	12	463
English sole	36	1,626	26	1,322	10	305
Eulachon	1	153	1	153	0	0
Flathead sole	9	354	7	262	2	92
Greenstriped rockfish	13	360	8	220	5	140
Kelp greenling	3	26	3	26	0	0
Lingcod	45	331	0	0	45	331
Longnose skate	51	155	51	155	0	0
Longspine thornyhead	1	96	1	96	0	0
Pacific cod	59	731	0	0	59	598
Pacific hake	12	595	11	548	1	47
Pacific halibut	34	116	34	116	0	0
Pacific herring	2	5	2	5	0	0
Pacific ocean perch	15	691	5	270	10	421
Pacific sand lance	1	2	1	2	0	0
Pacific sanddab	18	1,442	16	1,367	2	75
Pacific sardine	1	64	1	64	0	0
Petrale sole	54	412	0	0	54	412
Puget sound rockfish	1	29	1	29	0	0
Pygmy rockfish	1	25	0	0	1	25
Quillback rockfish	8	55	1	11	7	44
Redbanded rockfish	22	254	1	11	21	243
Redstripe rockfish	12	371	9	300	3	71
Rex sole	42	2,807	39	2,660	3	147
Rosethorn rockfish	5	91	1	2	4	89
Rougheye rockfish	5	131	0	0	5	131
Sablefish	22	536	10	160	12	375
Sandpaper skate	10	11	10	11	0	0
Sharpchin rockfish	11	508	8	406	3	102
Shortraker rockfish	6	10	0	0	6	10
Shortspine thornyhead	15	769	9	604	6	165
Silvergray rockfish	10	120	5	48	5	72
Slender sole	13	614	12	574	1	40
Southern rock sole	19	748	13	491	6	257
Spiny dogfish	35	1,497	35	1,497	0	0
Splitnose rockfish	8	506	4	317	4	189
Spotted ratfish	17	699	17	699	0	0
Starry flounder	1	1	1	1	0	0
Stripetail rockfish	3	47	0	0	3	47
Sturgeon poacher	1	2	1	2	0	0
Walleye pollock	8	404	8	404	0	0
Whitebait smelt	1	81	1	81	0	0
Yelloweye rockfish	13	65	0	0	13	65
Yellowmouth rockfish	1	26	0	0	1	26
Yellowtail rockfish	10	252	7	131	3	121
Total	805	22,480	454	16,529	351	5,819

Table 12: Biological characteristics of sampled species.

	Length (cm)			Weight (kg)			Sex Proportion	
Species	Min.	Max.	Mean	Min.	Max.	Mean	Male	Female
Arrowtooth flounder	13.0	75.0	46.4	0.24	3.88	1.27	0.35	0.65
Big skate	54.0	178.5	96.8				0.53	0.47
Bocaccio	49.1	83.2	65.3	1.56	8.24	3.89	0.77	0.23
Canary rockfish	33.7	67.8	46.3	0.66	3.42	1.78	0.46	0.54
Chinook salmon	61.2	72.2	67.4	3.18	5.28	4.26	1.00	0.00
Curlfin sole	19.0	37.0	27.7	0.17	0.50	0.30	0.57	0.43
Darkblotched rockfish	25.6	44.0	33.8	0.26	1.63	0.77	0.57	0.43
Dover sole	10.8	64.7	33.9	0.08	1.96	0.48	0.54	0.46
English sole	9.6	48.0	30.3	0.03	0.90	0.36	0.26	0.74
Eulachon	11.0	17.0	14.3				0.00	0.00
Flathead sole	20.6	44.2	30.5	0.06	0.82	0.30	0.37	0.63
Greenstriped rockfish	13.0	39.5	28.2	0.04	0.88	0.39	0.47	0.53
Kelp greenling	20.0	35.0	29.2				0.19	0.81
Lingcod	37.5	102.0	67.8	0.42	13.48	3.26	0.42	0.58
Longnose skate	20.0	140.0	82.6				0.46	0.54
Longspine thornyhead	12.0	28.0	21.9				0.49	0.51
Pacific cod	16.8	83.0	46.6	0.08	8.09	1.32	0.48	0.52
Pacific hake	40.0	73.0	49.5	0.43	1.35	0.67	0.36	0.64
Pacific halibut	57.0	106.0	77.5				0.68	0.32
Pacific herring	12.0	24.0	20.0				0.00	0.00
Pacific ocean perch	19.7	48.8	38.5	0.11	1.75	0.89	0.51	0.49
Pacific sand lance	17.0	18.0	17.5				0.00	0.00
Pacific sanddab	7.0	33.0	22.0	0.11	0.41	0.24	0.48	0.52
Pacific sardine	11.0	14.0	11.8				0.00	0.00
Petrale sole	18.1	55.2	38.5	0.06	2.61	0.74	0.44	0.56
Puget sound rockfish	9.0	14.0	12.3				0.00	0.00
Pygmy rockfish	20.0	22.5	21.1	0.09	0.14	0.12	0.00	1.00
Quillback rockfish	16.8	44.5	37.3	0.09	1.89	1.13	0.42	0.58
Redbanded rockfish	12.7	62.4	35.8	0.03	4.12	0.94	0.52	0.48
Redstripe rockfish	17.0	43.0	30.7	0.28	1.06	0.66	0.46	0.54
Rex sole	14.0	44.0	30.2	0.08	0.49	0.26	0.51	0.49
Rosethorn rockfish	11.9	33.2	26.8	0.02	0.69	0.31	0.51	0.49
Rougheye rockfish	17.3	57.4	45.5	0.07	3.09	1.46	0.56	0.44
Sablefish	43.0	86.5	60.1	0.82	6.74	2.33	0.63	0.37
Sandpaper skate	27.0	62.0	49.2				0.45	0.55
Sharpchin rockfish	12.0	38.0	24.6	0.05	0.79	0.29	0.55	0.42
Shortraker rockfish	58.1	80.5	68.7	3.19	8.28	5.79	0.30	0.70
Shortspine thornyhead	7.0	71.0	24.6	0.06	7.32	0.41	0.52	0.48
Silvergray rockfish	22.5	64.0	52.5	0.14	3.29	2.00	0.83	0.18
Slender sole	13.0	39.0	25.0	0.03	0.28	0.12	0.35	0.65
Southern rock sole	9.0	47.0	27.6	0.04	1.28	0.27	0.30	0.70
Spiny dogfish	47.0	118.0	72.8				0.58	0.41
Splitnose rockfish	10.0	40.0	24.3	0.07	1.25	0.42	0.60	0.40
Spotted ratfish	10.0	49.0	29.4				0.46	0.54
Starry flounder	50.0	50.0	50.0				0.00	1.00
Stripetail rockfish	16.5	30.8	23.2	0.07	0.46	0.21	0.57	0.43
Sturgeon poacher	14.0	19.0	16.5				0.00	0.00
Walleye pollock	19.0	54.0	32.2				0.39	0.61
Whitebait smelt	10.0	14.0	11.6				0.00	0.00
Yelloweye rockfish	20.5	73.6	54.3	0.56	7.66	3.63	0.42	0.58
Yellowmouth rockfish	42.4	50.4	46.8	1.23	2.06	1.68	0.81	0.19
Yellowtail rockfish	30.0	54.0	42.9	0.61	2.60	1.47	0.57	0.43

Table 13: Summary of data logged from ship board and net mounted systems.

Sensor	Attribute	Num. Tows	Num. Records
Depth sounder - unknown type	Bottom depth	103	338
Global positioning system (gps)	Vessel direction - compass bearing true north	91	64330
Global positioning system (gps)	Vessel position - latitude	106	8076
Global positioning system (gps)	Vessel position - longitude	106	8076
Global positioning system (gps)	Vessel speed over ground	91	64330
Nmfs bottom contact sensor	Bottom contact sensor tilt angle	68	26480
Seabird sbe39 temperature and pressure sensor	Net depth	89	20393
Seabird sbe39 temperature and pressure sensor	Water temperature at net depth	89	20393
Simrad fs20 trawl sonar	Net depth	89	293
Simrad fs20 trawl sonar	Trawl net headrope to bottom distance	92	303
Simrad fs20 trawl sonar	Trawl net mouth width	93	307
Simrad iti trawl system	Net depth	91	298
Simrad iti trawl system	Trawl net headrope to bottom distance	94	302
Simrad iti trawl system	Trawl net warp length	98	320
Simrad iti trawl system	Trawl net wingspread	59	193

FIGURES

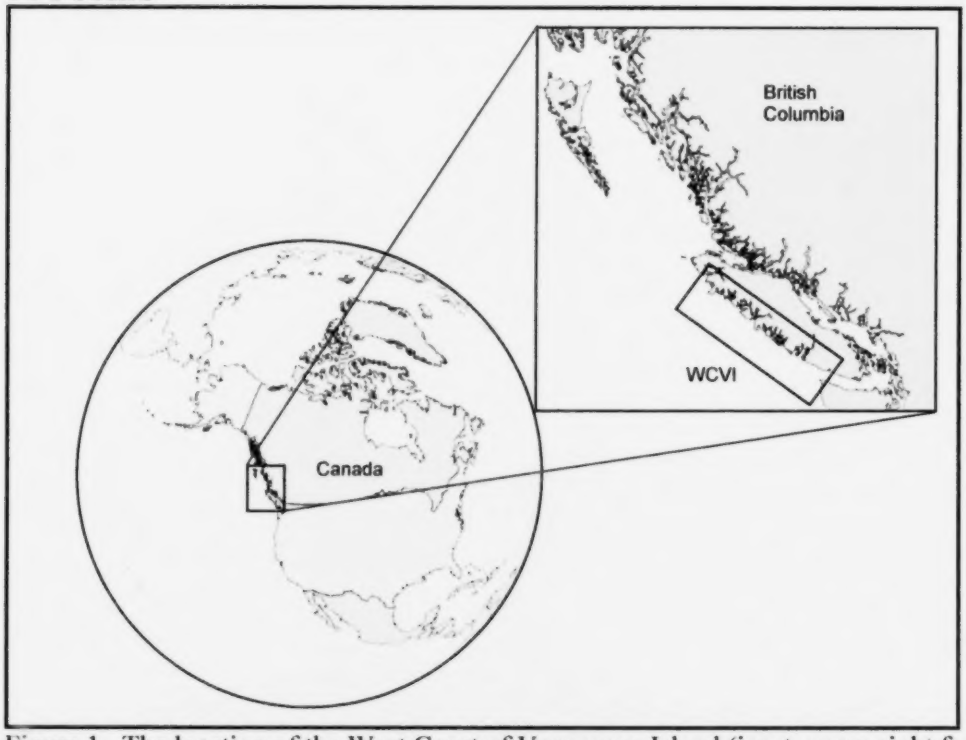

Figure 1. The location of the West Coast of Vancouver Island (inset, upper right frame) on the west coast of British Columbia, Canada.

Figure 2: The Government research trawler W.E. RICKER.

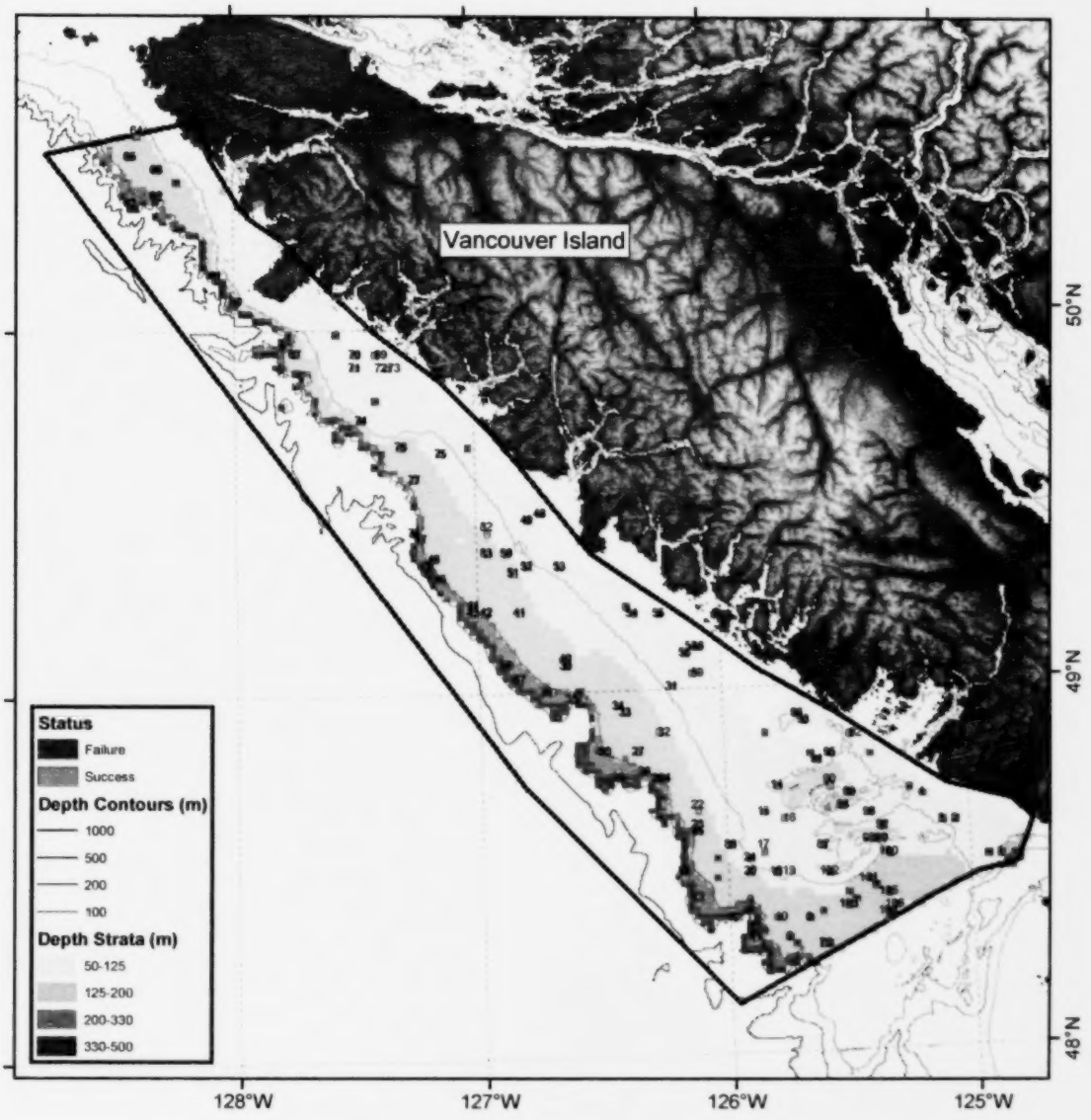

Figure 3: Map of the survey area off the West Coast of Vancouver Island. The thick black line outlines the survey frame; depth strata are represented by the four shades of blue; depth contours for 100, 200, 500, and 1000 m have been plotted. Survey blocks are shaded red or green depending on whether the site was successfully fished (green) or rejected (red), each block that was fished is labeled with its set number.

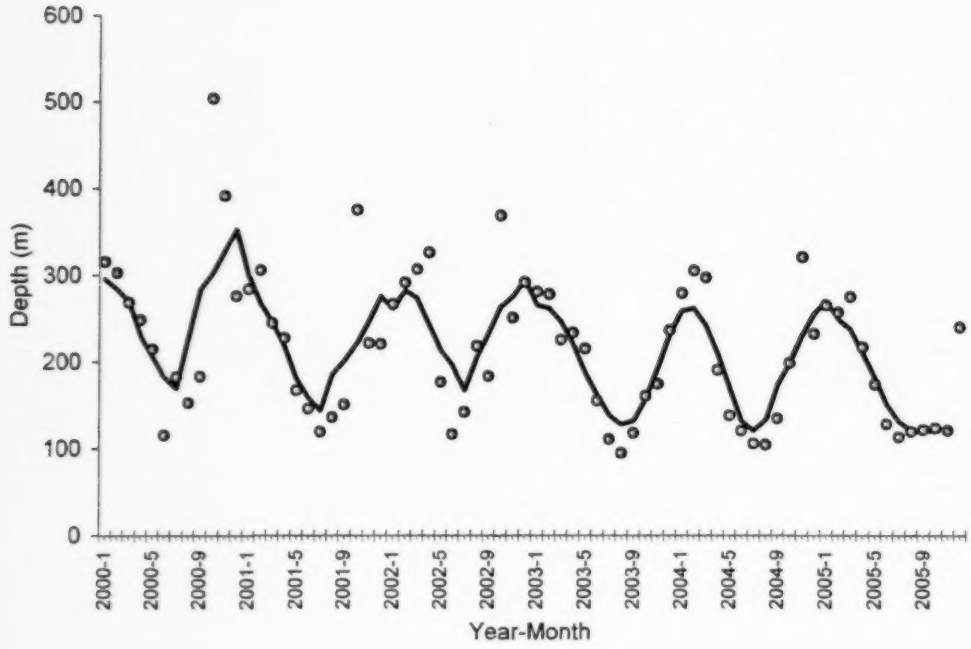

Figure 4: Mean depth of fishing activity off the West Coast of Vancouver Island by month.

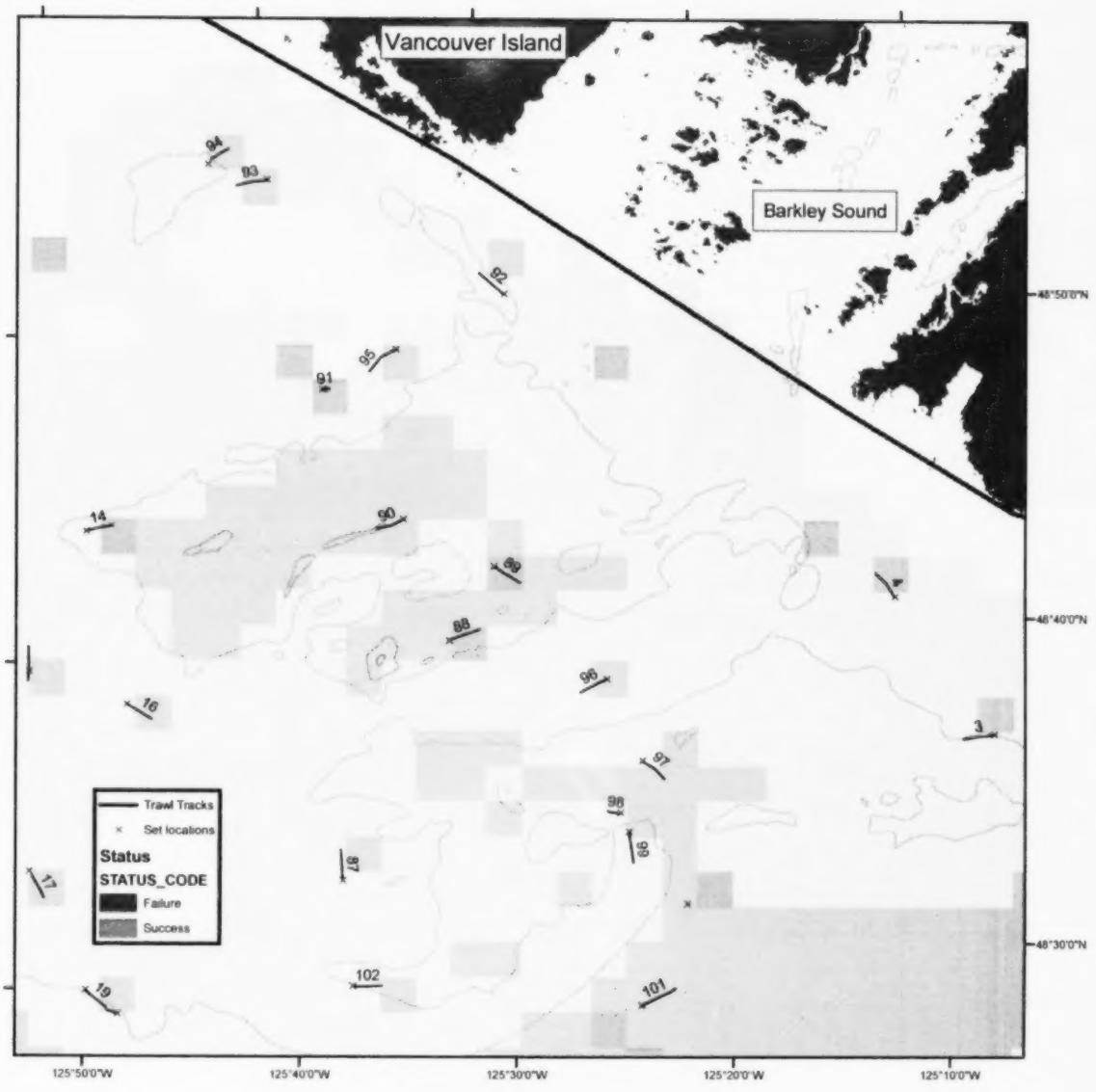

Figure 5: Example of trawl track lines plotted over target block locations.

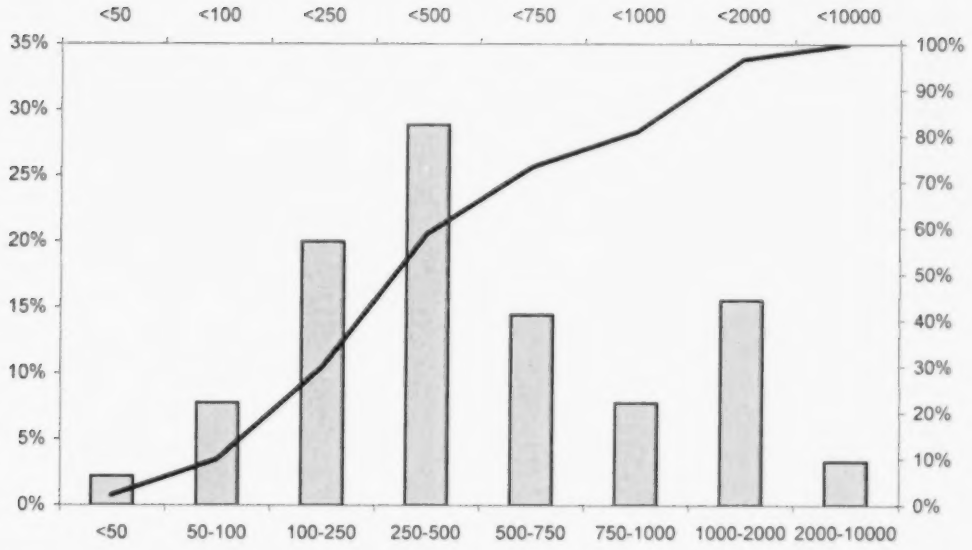

Figure 6: Distribution of catch size, the bars represent the proportion (left y axis) of total tow catch weights by group (lower x axis). The line represents the cumulative catch proportion by the same bins plotted on the upper x axis and right y axis.

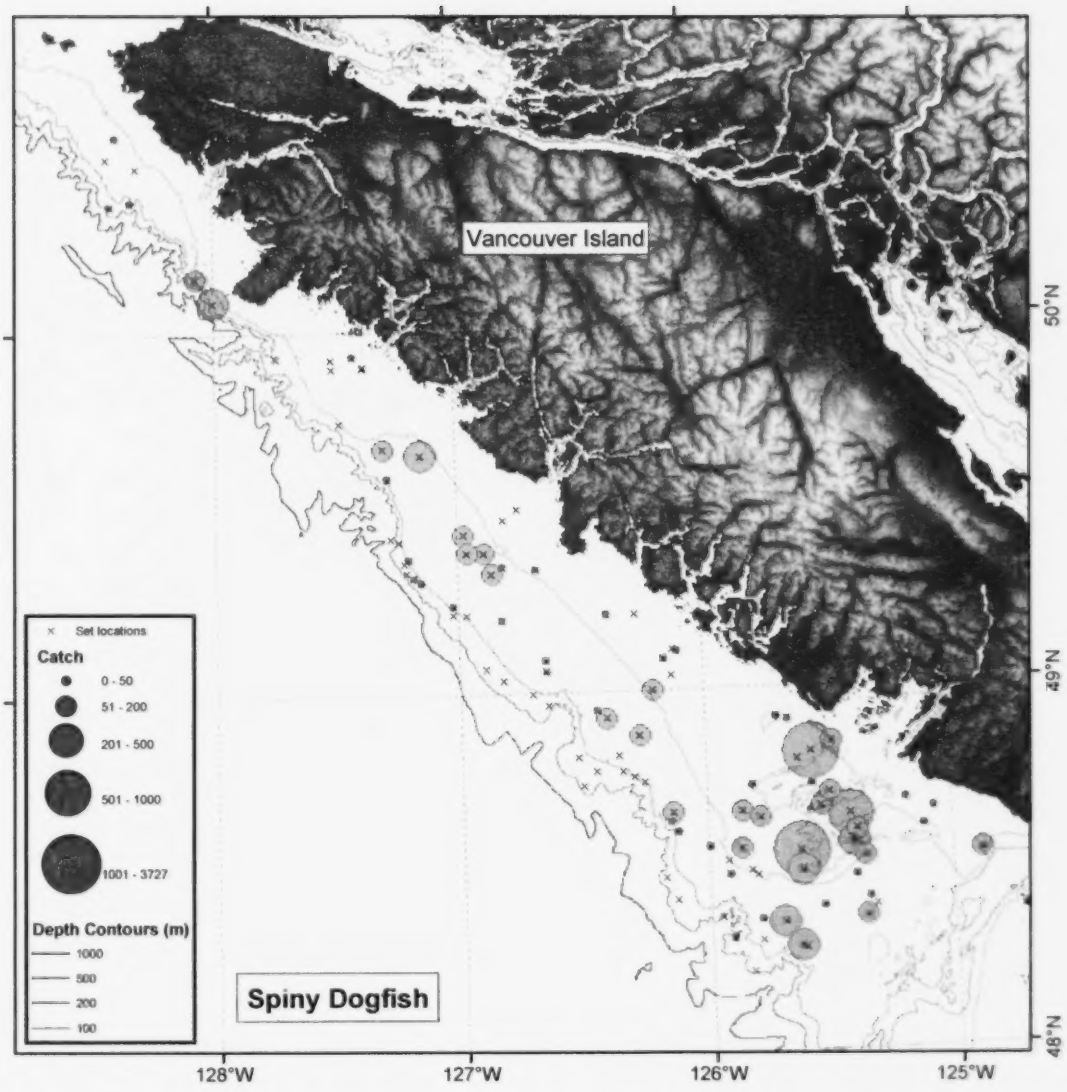

Figure 7: Distribution of spiny dogfish catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

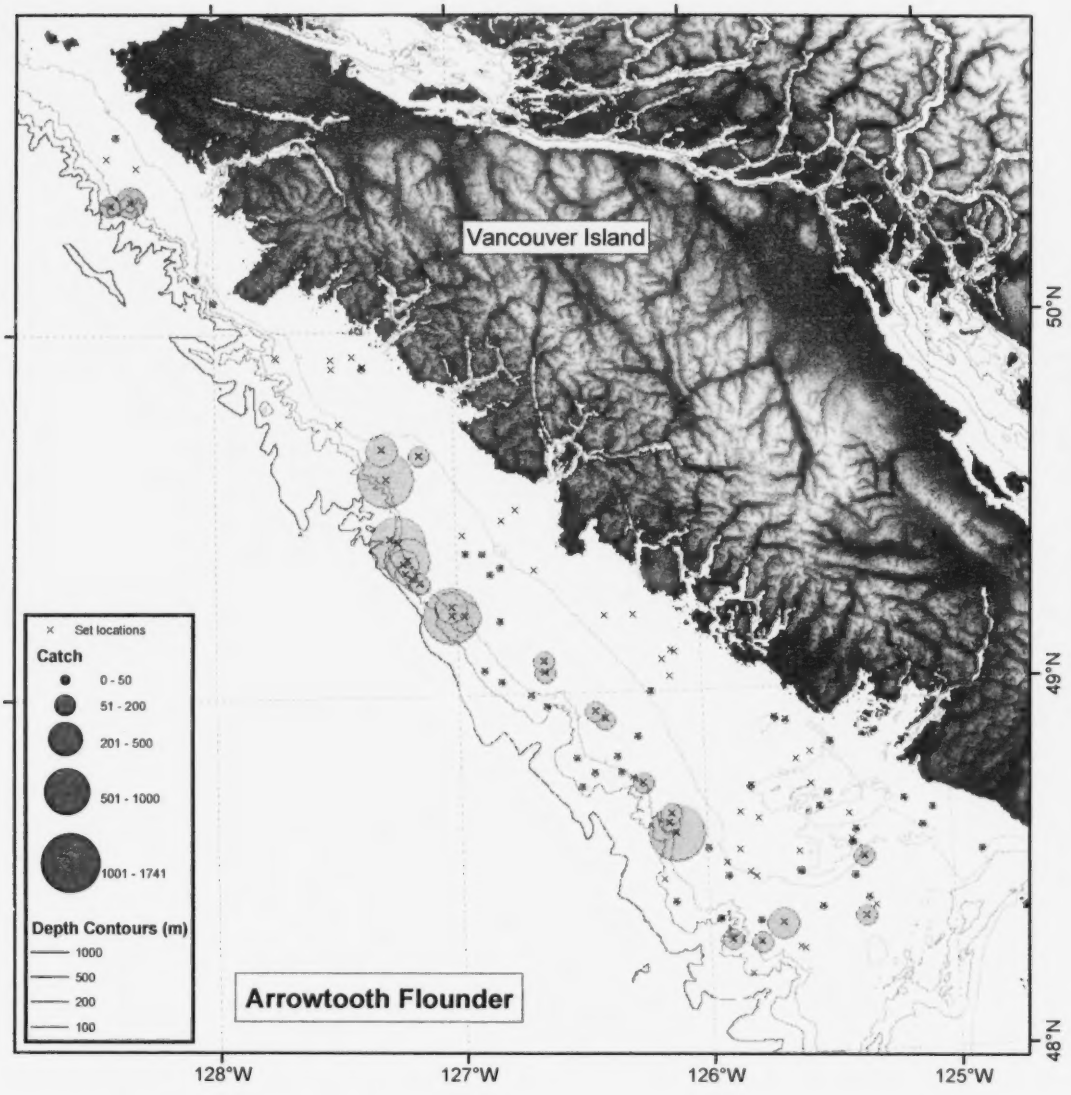

Figure 8: Distribution of arrowtooth flounder catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

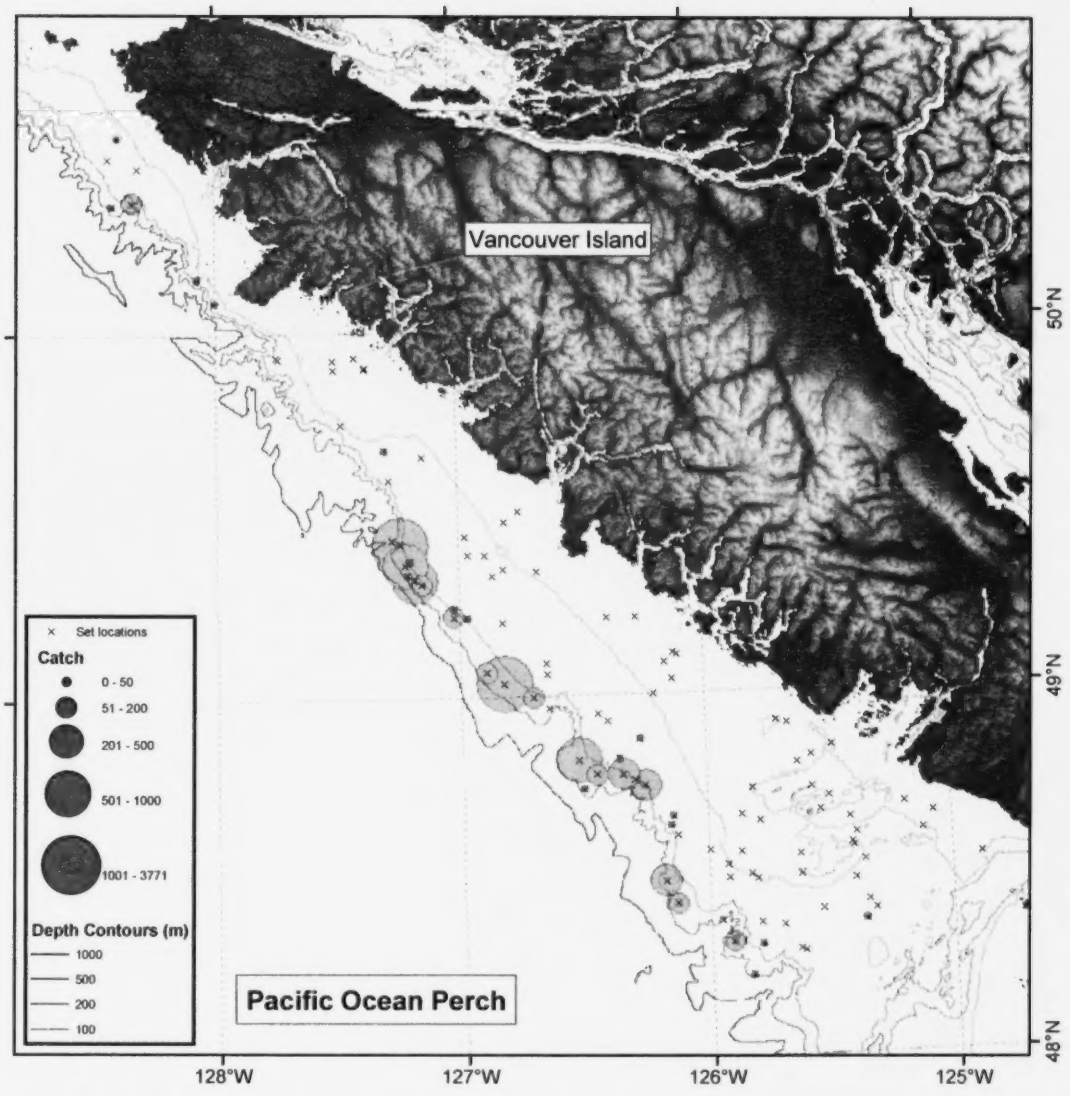

Figure 9: Distribution of Pacific Ocean perch catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

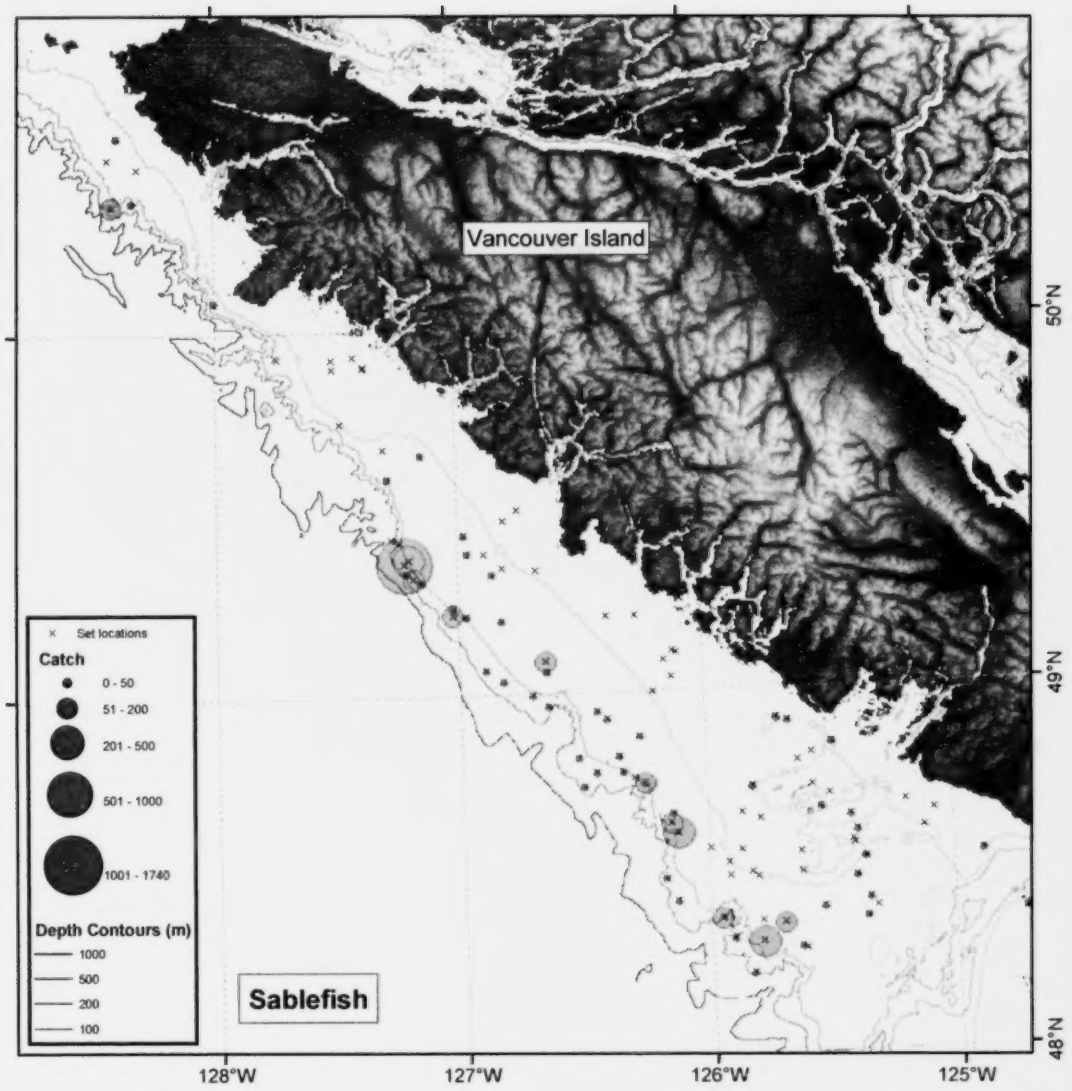

Figure 10: Distribution of sablefish catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

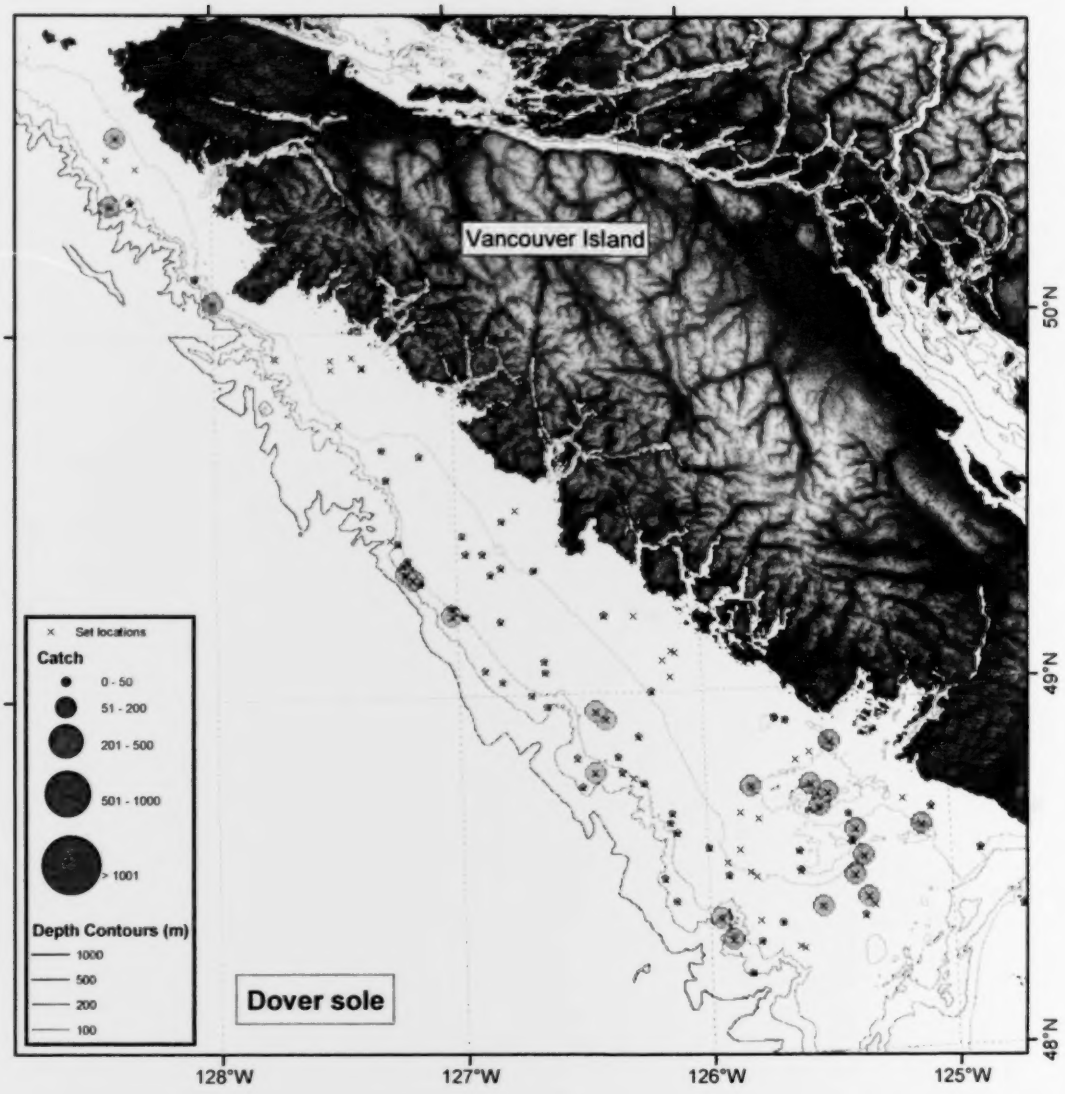

Figure 11: Distribution of Dover sole catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

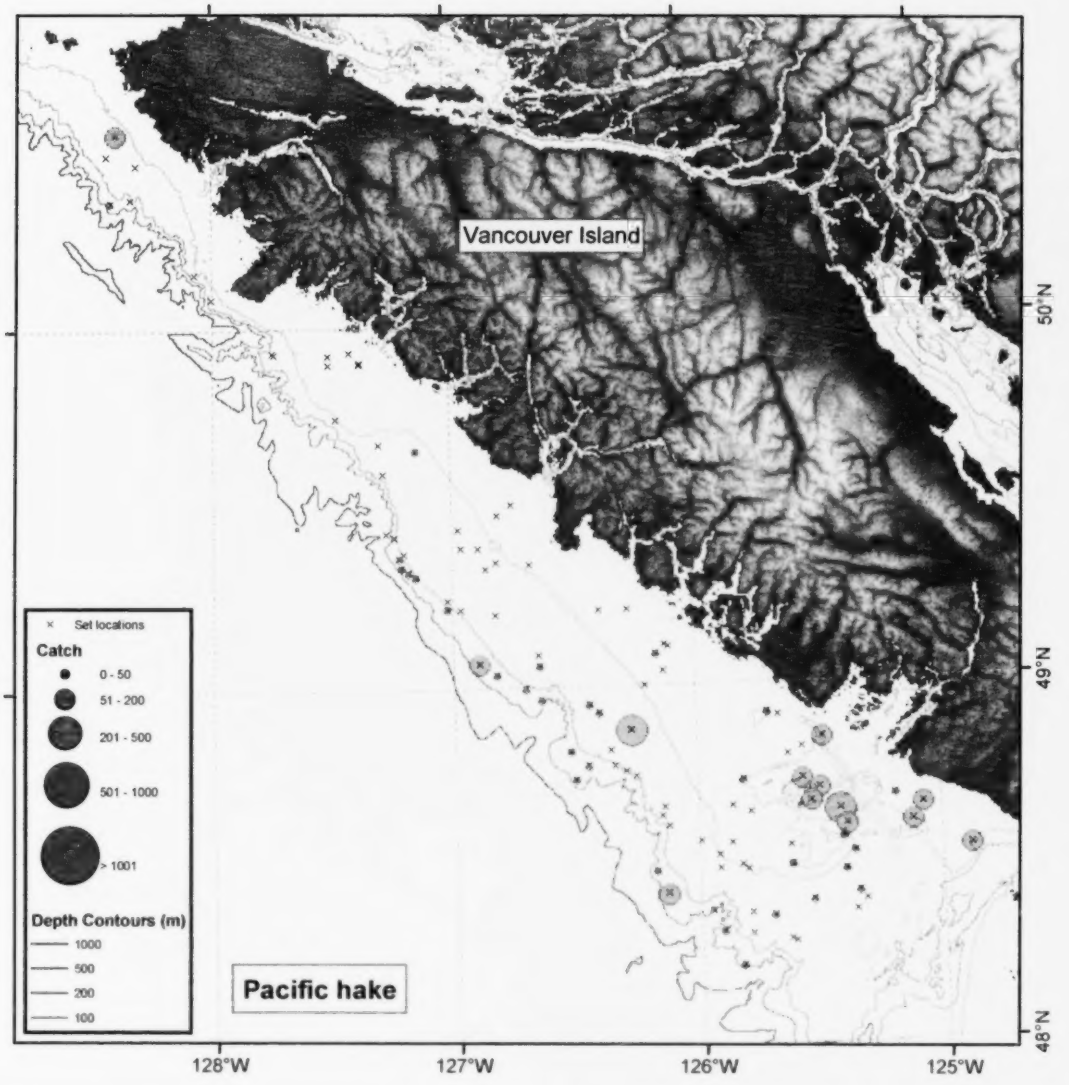

Figure 12: Distribution of Pacific hake catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

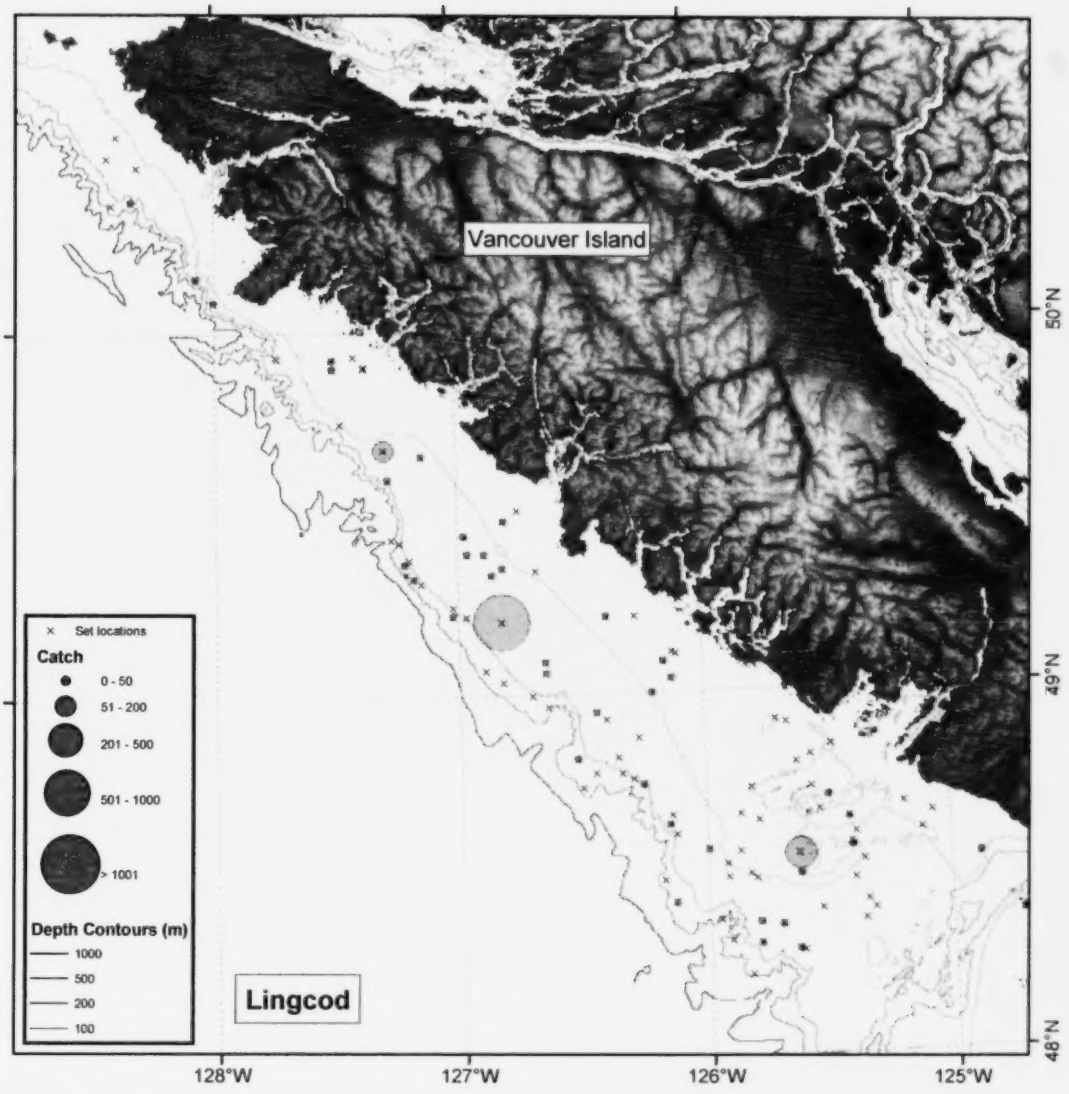

Figure 13: Distribution of lingcod catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

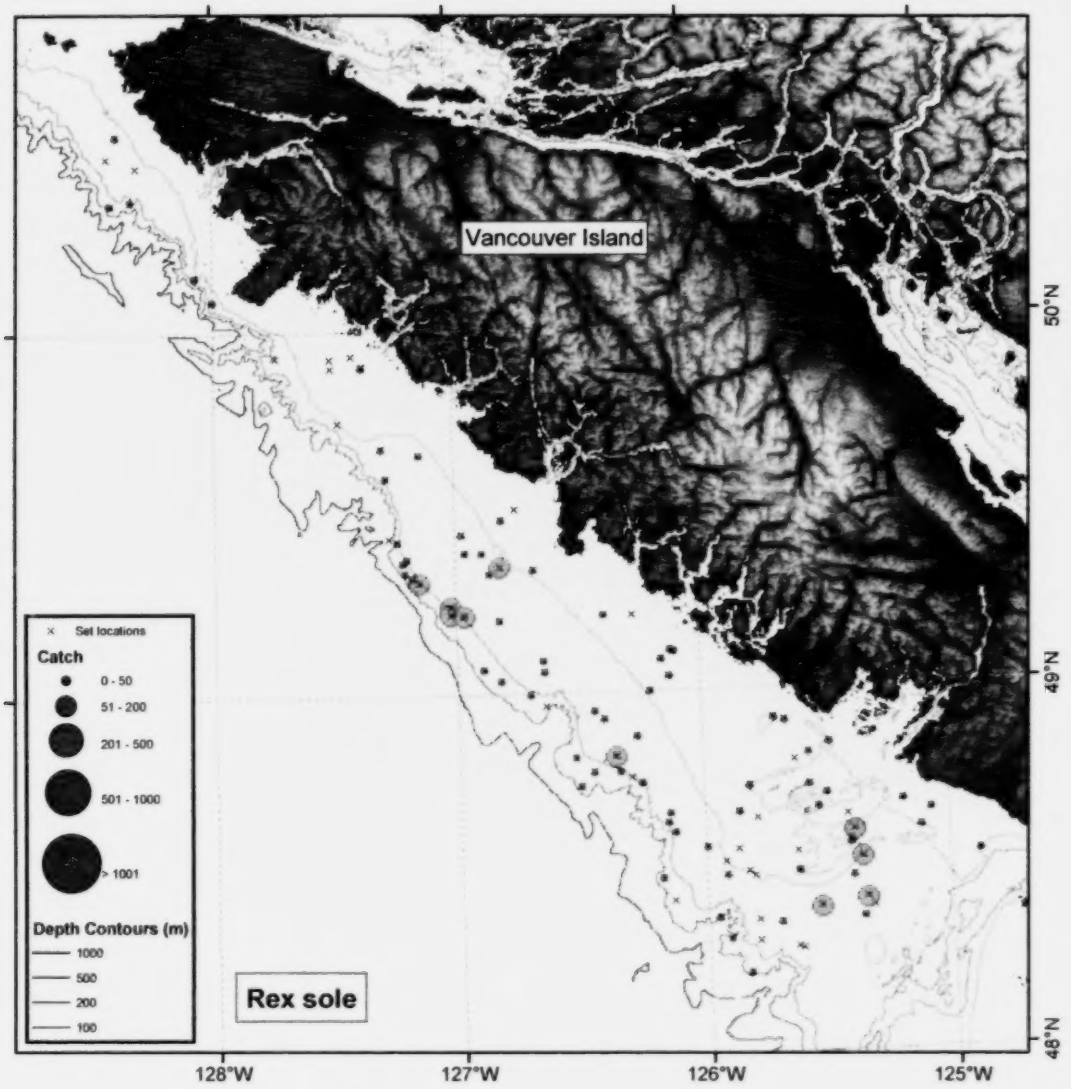

Figure 14: Distribution of rex sole catches (kg), circles are scaled to catch size, sets with no catch are represented by the x symbol.

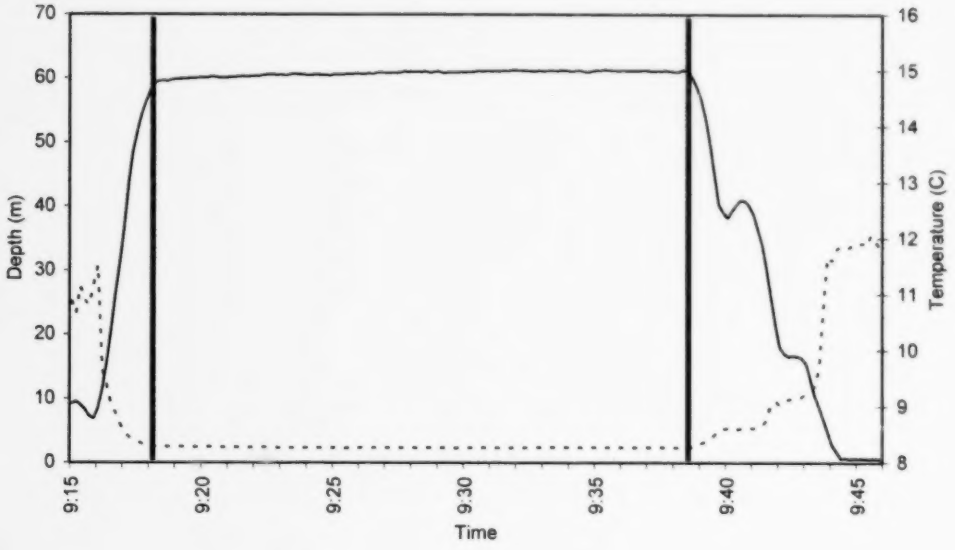

Figure 15: Example Seabird temperature and depth profile for set 56, the solid black line is depth and the dashed line is temperature, start and end bottom contact times are indicated by the vertical lines.

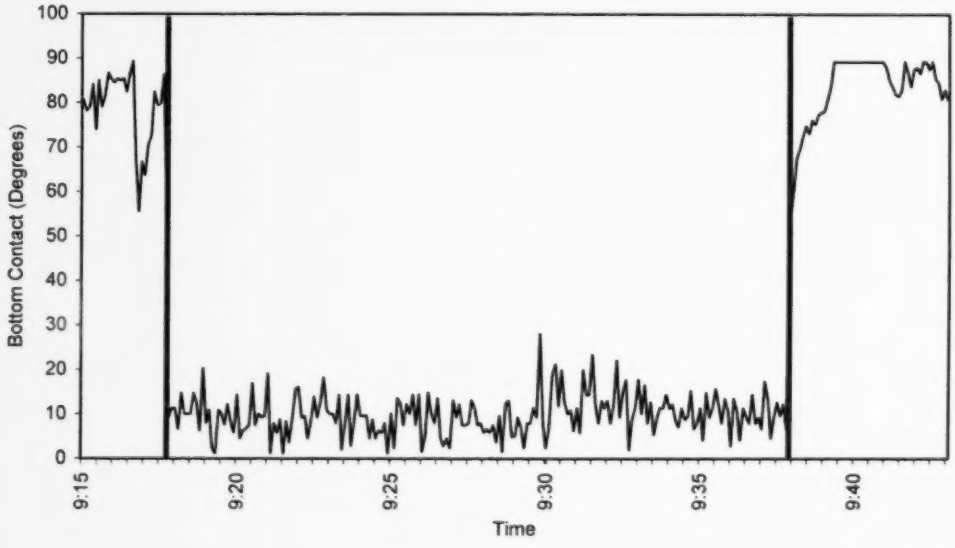

Figure 16: Bottom contact sensor trace for set 56, a tow on smooth mud or sand bottom. Start and end bottom contact times are indicated by the vertical lines.

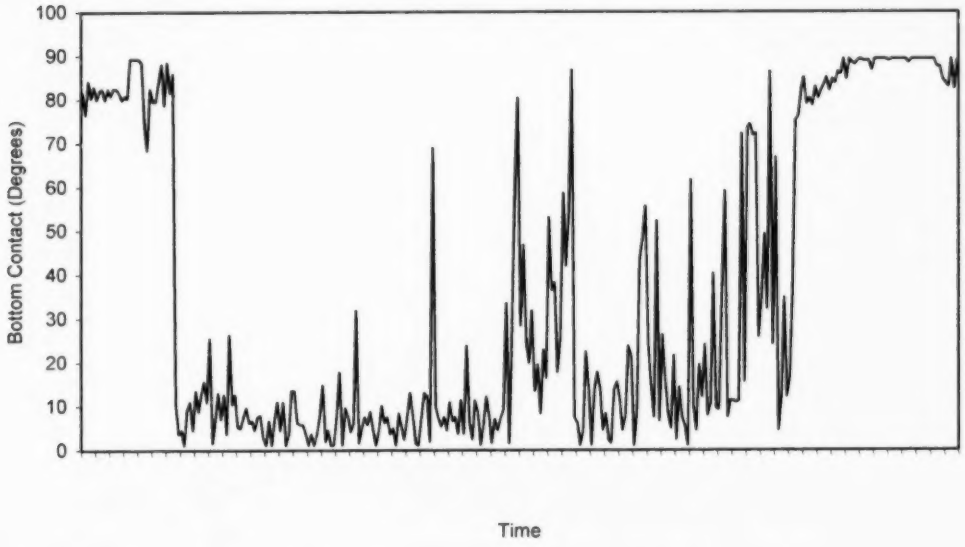

Figure 17: Bottom contact sensor trace for set 77 on rough bottom.

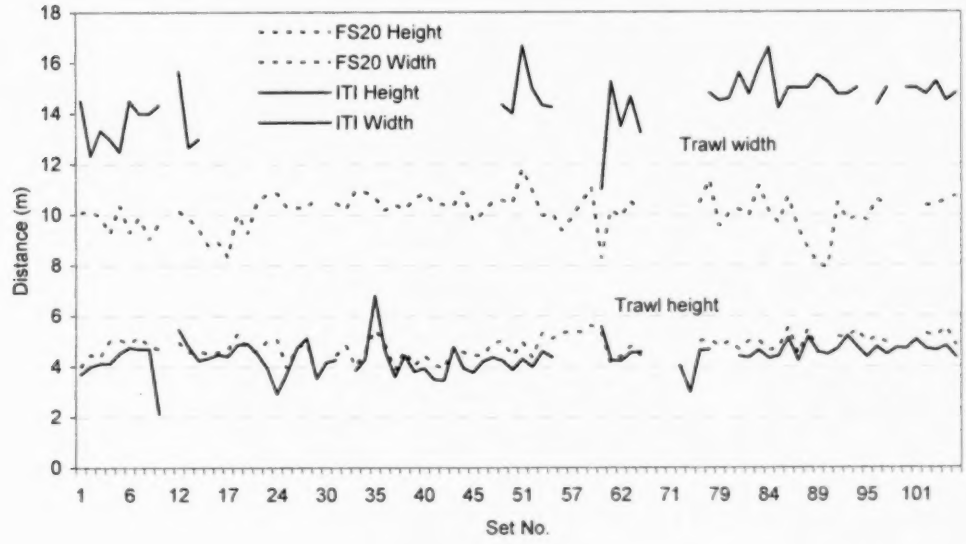

Figure 18: Trawl height and wingtip spread as measured with the SIMRAD ITI system as well as the Furuno FS20 net sonar.

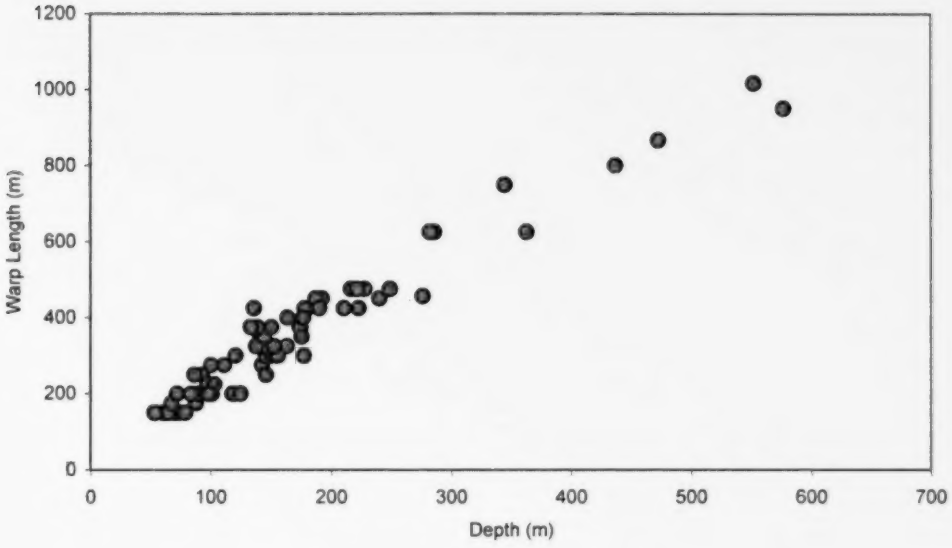

Figure 19: Plot of the length of main warp length deployed against the depth fished.

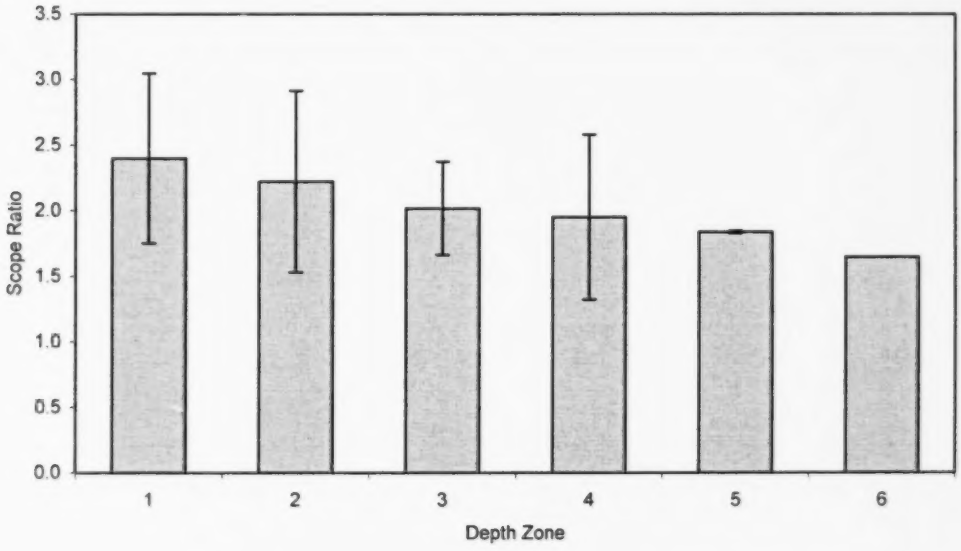

Figure 20: Mean scope ratio by depth zone, 1 = 0-100 m, 2= 101 – 200 m, 3 = 201 – 300 m, etc. Error bars are 1.96 standard deviations.

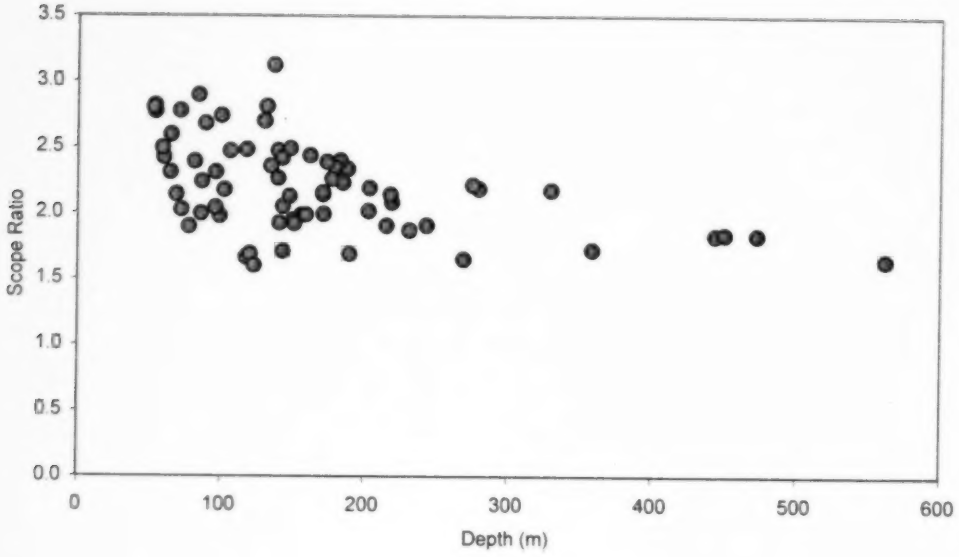

Figure 21: Plot of scope ratio and depth fished.

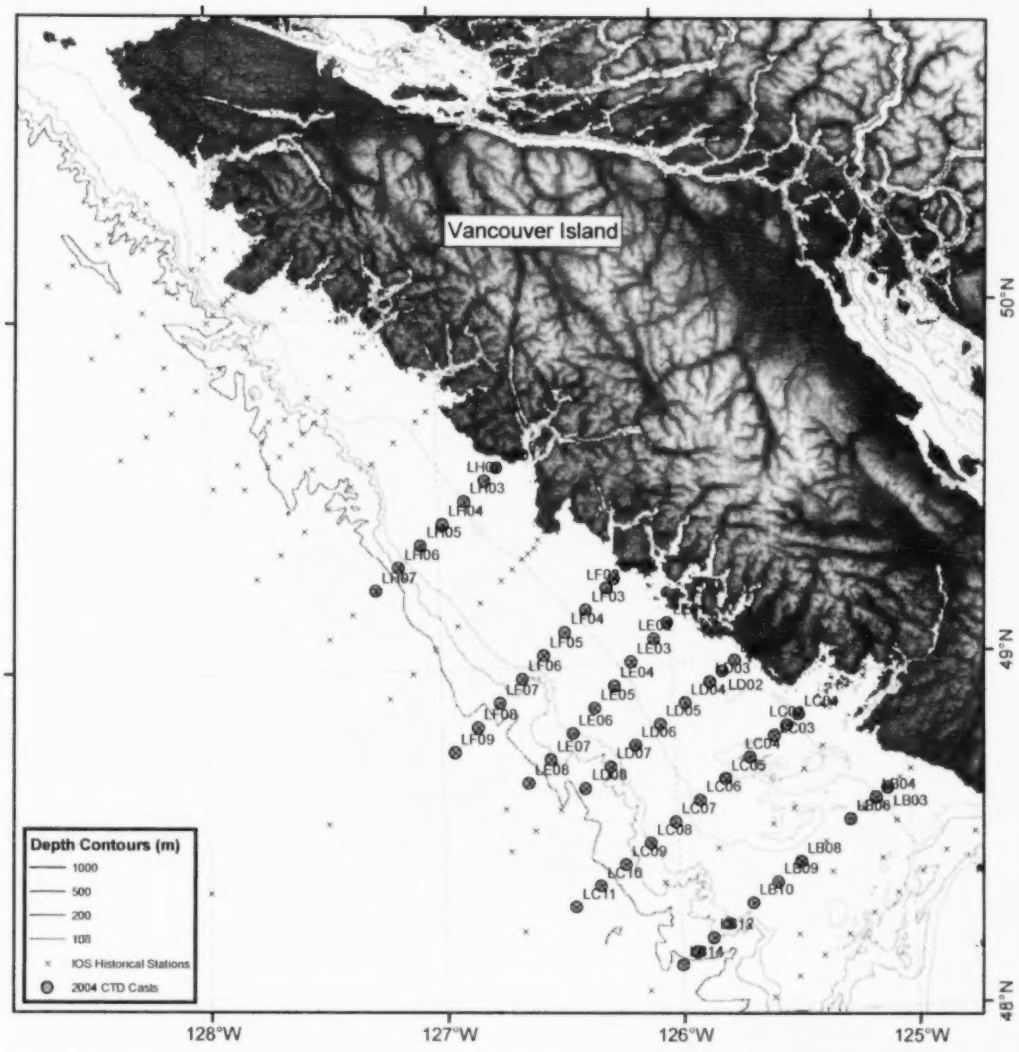

Figure 22: CTD stations occupied during the 2004 WCVI groundfish bottom trawl survey

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APPENDICES

Appendix 1: Criteria used to determine sole maturity stages.

Maturity stage	Code	Testes	Ovaries
Immature	1	Testes very small string–like and somewhat translucent or pinkish in colour.	Ovaries very small, translucent or pinkish in colour and somewhat gelatinous in texture.
Maturing	2	Testes enlarged, a distinct bulge evident but still translucent or pinkish in colour.	Ovaries relatively small, pinkish-yellow or cream in colour, granular in texture. No distinct eggs visible.
Developing	3	Testes enlarged, brown-white or white in colour, firm in texture.	Ovaries large, cream or yellow in colour, containing opaque eggs that can be distinguished by direct observation. Sex may be determined externally.
Running Ripe	4	Testes large, white and easily broken. No sperm evident.	Ovaries containing partly or wholly translucent eggs. Sex easily determined externally.
Spawning	5	Testes large, white and sperm evident.	Ovaries containing entirely translucent, mature ova. Eggs loose and will run from oviducts under slight pressure.
Spent	6	Testes flaccid, shrunken and yellow-brown in colour. Sperm ducts enlarged and a small amount of sperm may be present.	Ovaries large, flaccid and purple in colour; a few translucent eggs may be left. Ovarian membrane very bloodshot and sac-like.
Resting	7	Testes firm, small and yellow-brown in colour. Sperm ducts small.	Ovaries contracted and firm, pinkish-grey to cream-yellow in colour and may appear granular in texture but no distinct eggs are visible.

Appendix 2: Bridge Log details.

Tow	Date	Time	Latitude	Longitude	Depth	Duration	Speed	Warp	Direction	Block	Catch	Usability
1	5/26	14:07	48 32.11	124 52.99	89	22	5.2	250	80	3536	606.7	Yes
2	5/26	16:09	48 39.25	125 4.69	86	19	6.3	250	150	3832	677.3	Yes
3	5/26	17:41	48 36.47	125 7.22	100	16	5.4	200	276	3830	463.5	Yes
4	5/26	18:51	48 40.86	125 11.53	74	16	5.1	150	320	4419	132.70	Yes
5	5/27	7:24	48 13.31	125 50.17	462	22	4.9	900	102	400	151.4	Yes
6	5/27	9:00	48 18.43	125 47.71	170	15	5.7	375	307	1143	791.6	Yes
7	5/27	10:30	48 17.41	125 38.29	140	20	6.1	350	237	1000	289.2	Yes
8	5/27	11:20	48 17.03	125 37.19	134	14	5.7	250	55	1001	264.90	No
9	5/27	12:38	48 21.43	125 42.2	142	17	5.9	275		1590	948.7	Yes
10	5/27	13:46	48 21.87	125 47.64	143	20	5.6	300	305	1585	122.3	Yes
11	5/27	15:15	48 18.9	125 54.77	308	20	5.2	700	241	1138	635.5	Yes
12	5/27	16:44	48 22.38	125 57.38	536	20	4.8	950	239	1579	309.3	Yes
13	5/27	18:31	48 25.51	126 8.22	279	20	5.4	625	326	2017	519.4	Yes
14	5/28	7:14	48 43.94	125 48.88	118	20	4.9	200	84	4545	366.2	Yes
15	5/28	8:33	48 39.72	125 51.8	70	18	5.9	150	7	3951	169.40	Yes
16	5/28	9:31	48 38.6	125 47.32	60	19	5.2	150	134	3806	108.5	Yes
17	5/28	10:46	48 33.59	125 52.13	78	19	5.2	150	162	3063	117.25	Yes
18	5/28	12:11	48 29.11	125 48.32	97	13	5.3	225	296	2621	181.8	No
19	5/28	12:50	48 29.89	125 49.73	94	18	5.8	225	132	2621	1,087.10	Yes
20	5/28	14:30	48 29.42	125 55.2	121	20	5.3	200	247	2617	70.5	Yes
21	5/28	15:40	48 31.6	125 55.43	96	6	5	200	314	2913	8.9	No
22	5/29	8:31	48 39.85	126 8.61	142	11	5.5	250	173	3941	367.9	Yes
23	5/29	9:23	48 38.34	126 9.25	158	20	5.2	300	322	3645	423.5	Yes
24	5/29	10:35	48 45	126 15.32	172	20	6	375	302	4676	967.7	Yes
25	5/29	12:15	48 45.93	126 17.81	376	12	4.4	600	188	4675	211.6	No
26	5/29	13:08	48 46.81	126 20.58	223	20	5.8	450	298	4821	1,431.00	Yes
27	5/29	14:04	48 49.46	126 21.5	170	20	6	350	319	5264	189.4	Yes
28	5/29	15:22	48 46.94	126 27.13	270	20	4.2	450	268	4817	435.6	Yes
29	5/29	16:40	48 44.63	126 30.26	458	20	4.8	800	308	4519	145.2	Yes
30	5/29	18:11	48 49.31	126 31.4	221	20	4.9	475	337	5259	1,166.90	Yes
31	5/30	7:09	49 0.01	126 12.64	86	19	5.7	200	343	6749	298.4	Yes
32	5/30	8:54	48 52.62	126 16.24	130	22	5.7	300	326	5711	512	Yes
33	5/30	10:21	48 55.68	126 24.17	150	21	5	300	320	6150	525.7	Yes
34	5/30	11:12	48 56.95	126 26.5	151	18	4.6	300	327	6297	299.2	Yes
35	5/30	13:42	48 57.93	126 38.39	450	20	4.3	1050	352	6438	216.3	Yes
36	5/30	14:56	48 59.81	126 42.17	242	21	5.4	475	296	6583	373.9	Yes
37	5/30	16:06	49 2.13	126 49.38	268	23	5.1	625	315	6874	1,307.50	Yes
38	5/30	17:43	49 4.06	126 53.6	330	24	4.9	750	331	7168	320.7	Yes
39	5/31	7:13	49 3.56	126 38.72	140	21	5.6	325	315	7177	361	Yes
40	5/31	8:12	49 5.36	126 38.87	135	21	5.6	325	325	7325	520.5	Yes
41	5/31	9:43	49 12.06	126 49.42	142	20	5.6	350	326	8354	1,655.30	Yes
42	5/31	10:54	49 13.01	126 58.1	186	22	6.1	450	315	8349	605.4	Yes
43	5/31	12:17	49 13.16	127 1.42	222	22	6.1	425	310	8347	1,809.00	Yes
44	5/31	13:56	49 14.58	127 1.36	182	22	5.6	450	292	8495	1,061.50	Yes
45	5/31	15:16	49 18.54	127 9.31	206	22	5.9	475	325	9082	508.90	Yes
46	5/31	16:29	49 22.42	127 12.2	184	21	5.9	425	153	9525	1,790.18	Yes

Appendix 2: Continued

Tow	Date	Time	Latitude	Longitude	Depth	Duration	Speed	Warp	Direction	Block	Catch	Usability
47	5/31	18:05	49 25.23	127 14.43	210	21	5.9	475	357	9967	6,803.99	Yes
48	6/1	7:46	49 30.27	126 45.11	46	10	5.7	100	190	10577	38.84	No
49	6/1	8:29	49 28.58	126 48.59	64	20	5.6	175	173	10427	103.1	Yes
50	6/1	9:44	49 23.16	126 53.52	126	20	6.5	275	169	9684	186.1	Yes
51	6/1	10:34	49 19.71	126 51.72	130	21	5.7	375	164	9241	296.1	Yes
52	6/1	12:08	49 20.84	126 49.09	132	21	5.2	400	136	9391	228.6	Yes
53	6/1	14:50	49 20.33	126 40.84	89	18	5.6	225	123	9396	147.7	Yes
54	6/1	17:45	49 12.6	126 23.66	72	21	5.4	175	139	8371	194.3	Yes
55	6/2	7:23	49 12.62	126 16.57	49	2	5.4		152	8375	8.40	No
56	6/2	9:18	49 5.13	126 9.73	58	19	6.4	150	329	7491	95.2	Yes
57	6/2	10:29	49 6.69	126 7.5	53	19	4.9	150	153	7640	53.56	Yes
58	6/2	11:17	49 6.35	126 6.61	53	19	4.6	150	162	7641	66.7	Yes
59	6/2	12:50	49 2.37	126 7.92	64	20	4.8	150	163	7048	67	Yes
60	6/3	7:28	50 5.08	128 0.23	179	22	4.9	425	150	15267	812	Yes
61	6/3	9:43	50 9.15	128 4.61	205	17	5.2	300		15856	248.9	Yes
62	6/3	13:24	50 21.67	128 20.95	278	19	5.9	425	96	17623	1,066.30	Yes
63	6/3	14:41	50 21.17	128 26.06	360	21	4.7	625	330	17471	385.9	Yes
64	6/3	16:40	50 32.44	128 24.73	159	20	5.4	325	151	18952	430.8	Yes
65	6/3	18:04	50 28.95	128 27.07	181	6	5.1	400	150	18507	130.9	No
66	6/3	19:05	50 27.32	128 19.55	160	12	5.2	375	130	18215	278.9	No
67	6/4	15:39	49 56.05	127 44.93	153	20	4.6	350	147	14092	251.7	No
68	6/4	17:47	49 55.8	127 44.51	150	20	4.4	375	146	14092	716.3	No
69	6/5	7:53	49 55.91	127 25.41	60	17	5.7	200	208	14104	31.7	Yes
70	6/5	8:51	49 55.49	127 30.71	63	20	5.1	200	227	14101	35.7	Yes
71	6/5	9:44	49 53.98	127 30.68	72	20	5.6	225	129	13805	62.9	Yes
72	6/5	11:01	49 54.02	127 22.8	60	22	4.9	200	122	13810	77.7	Yes
73	6/5	12:29	49 54.27	127 22.78	60	20	4.8	200	120	13810	137.2	No
74	6/5	14:43	49 44.9	127 29	114	3	7.2	250		12622	50.3	No
75	6/6	7:18	49 39.42	127 8.81	112	21	5.2	275	192	11894	764.2	Yes
76	6/6	8:47	49 40.64	127 18.19	132	20	4.8	350	304	12036	819.3	Yes
77	6/6	10:38	49 35.74	127 17.23	147	21	5.1	350	132	11298	1,937.50	Yes
78	6/6	12:40	49 25.84	127 16.5	705	10	2.7	1050	195	10114	54.7	No
79	6/6	13:50	49 21.79	127 13.36	230	21	4.8	525		9376	2,400.40	Yes
80	6/6	14:52	49 20.18	127 12.79	375	22	4.6	700	128	9228	412.8	Yes
81	6/6	16:02	49 19.33	127 11.09	258	22	5.3	550	336	9081	1,460.30	Yes
82	6/6	17:47	49 26.29	126 58.49	122	20	5.1	300	122	10125	284.00	Yes
83	6/6	18:45	49 23.2	126 57.8	138	19	5	350	156	9681	221.3	Yes
84	6/7	7:49	48 29.21	126 10.87	340	19	4.7	650	180	2459	489.60	Yes
85	6/7	9:30	48 36.63	126 7.6	149	19	5.6	325	350	3497	1,544.00	Yes
86	6/7	11:03	48 33.99	125 59.84	109	19	5.2	275	310	3206	133.90	Yes
87	6/7	13:38	48 32.93	125 37.67	65	20	5.5	175	0	3220	4,610.90	Yes
88	6/7	15:15	48 40.14	125 32.32	170	20	5.8	425		4111	358.00	Yes
89	6/7	16:15	48 42.35	125 30.09	140	21	5.4	350	124	4408	392.05	Yes
90	6/7	17:43	48 43.92	125 34.22	184	19	5	400	260	4553	439.8	Yes
91	6/7	18:58	48 48.01	125 37.7	48	4	4.5	200	82	5143	66.3	No
92	6/8	7:25	48 50.72	125 29.08	103	19	5.7	225	310	5740	851.8	Yes
93	6/8	8:54	48 54.52	125 39.89	81	19	5.3	200	258	6029	726.8	Yes

Appendix 2: Continued

Tow	Date	Time	Latitude	Longitude	Depth	Duration	Speed	Warp	Direction	Block	Catch	Usability
94	6/8	9:47	48 55.07	125 42.6	96	20	4.8	200	50	6176	135.6	Yes
95	6/8	11:18	48 49.16	125 34.22	54	20	5.7	150	240	5293	1,228.80	Yes
96	6/8	13:23	48 38.75	125 25.1	71	20	5	200	245	3967	1,765.00	Yes
97	6/8	14:18	48 36.19	125 23.61	122	21	5.2	350	135	3673	711.5	Yes
98	6/8	15:20	48 34.62	125 24.73	128	10	4.6	350		3376	368.3	No
99	6/8	16:15	48 34.03	125 24.38	84	20	5.2	250	172	3376	731.4	Yes
100	6/8	17:43	48 31.73	125 21.82	142	21	5.5	375	201	3082	463.2	Yes
101	6/8	18:49	48 28.68	125 24.14	148	25	5.6	375	130	2487	336.2	Yes
102	6/9	7:25	48 29.66	125 37.41	102	21	5	275	100	2629	591.9	Yes
103	6/9	9:23	48 23.85	125 32.43	128	21	5.3	375	130	1892	267.6	Yes
104	6/9	10:40	48 21.98	125 21.89	118	16	5.2	300	22	1750	355.3	Yes
105	6/9	12:06	48 25.05	125 20.98	160	20	5.3	400	46	2194	438.1	Yes
106	6/9	13:03	48 23.67	125 19.41	114	14	5	300	102	1899	195.2	No

Appendix 3: Tow by Tow catch details for the most common 50 species encountered during the survey.

Species	1	2	3	4	5	6	7	8	9	10
Arrowtooth flounder	48.30	8.60	28.30	4.50	-	116.10	-	-	224.00	12.90
Big skate	-	30.00	-	7.30	-	-	-	-	-	-
Bigfin eelpout	-	-	-	-	-	-	-	-	-	-
Black eelpout	-	-	-	-	1.70	-	-	-	-	-
Bocaccio	-	-	-	-	-	-	-	29.20	-	-
Canary rockfish	-	-	-	-	-	-	2.60	-	-	32.20
Curlfin sole	-	-	-	1.90	-	-	-	-	-	-
Darkblotched rockfish	-	-	-	-	-	-	-	-	-	-
Dover sole	38.00	4.90	78.20	-	27.00	13.20	-	-	9.30	-
English sole	-	193.50	25.70	27.10	0.70	-	-	-	33.50	14.40
Eulachon	-	-	-	-	-	-	-	-	-	-
Flathead sole	-	3.00	5.90	18.60	-	-	-	-	-	-
Greenstriped rockfish	0.50	-	-	-	-	48.90	-	0.40	2.00	0.50
Kelp greenling	5.80	-	-	-	-	-	-	-	-	-
Lingcod	9.10	-	-	-	-	36.20	5.60	30.10	11.30	2.70
Longnose skate	4.70	-	8.60	6.90	1.30	-	-	-	-	-
Longspine thornyhead	-	-	-	-	5.40	-	-	-	-	-
Pacific cod	33.30	8.60	9.80	1.40	-	13.70	-	-	4.80	-
Pacific hake	113.40	57.40	164.70	3.90	3.20	-	-	-	0.90	-
Pacific halibut	15.10	7.70	-	3.20	-	-	47.10	46.30	14.80	-
Pacific ocean perch	-	-	-	-	-	1.30	-	-	-	-
Pacific sanddab	-	3.10	-	14.40	-	-	-	-	-	-
Petrale sole	5.00	1.30	1.80	2.30	-	-	5.80	-	5.90	5.00
Puget sound rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	0.50	-	-	-	-
Quillback rockfish	10.40	-	-	-	-	-	-	-	-	-
Redbanded rockfish	-	-	-	-	-	-	-	-	3.40	-
Redstripe rockfish	-	-	-	-	-	0.90	-	-	3.30	-
Rex sole	8.70	33.50	15.20	11.70	1.00	-	-	-	0.40	-
Rosethorn rockfish	-	-	-	-	-	40.70	-	0.30	-	-
Rougheye rockfish	-	-	-	-	2.60	-	-	-	-	-
Sablefish	0.90	-	-	-	47.60	462.80	3.60	-	169.10	-
Sandpaper skate	-	-	-	-	-	-	-	-	-	-
Sharpchin rockfish	-	-	-	-	-	27.40	-	0.30	-	-
Shortraker rockfish	-	-	-	-	8.60	-	-	-	-	-
Shortspine thornyhead	-	-	-	-	38.20	-	-	-	-	-
Silvergray rockfish	-	-	-	-	-	2.60	-	23.60	-	3.30
Slender sole	-	0.60	3.30	0.40	-	-	-	-	-	-
Southern rock sole	-	-	-	0.70	-	-	-	-	-	0.20
Spiny dogfish	175.90	27.30	43.50	22.70	-	-	221.10	61.70	439.80	48.20
Splitnose rockfish	-	-	-	-	2.70	-	-	-	-	-
Spotted ratfish	126.60	16.10	14.80	1.70	1.10	2.70	-	-	2.80	-
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	3.30	-	-	-	-	-	-	-	-	-
Walleye pollock	-	281.70	62.80	3.00	-	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	23.60	3.40	72.50	15.40	2.90
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	7.60	-	-	-	-	-	-	-	8.00	-
Other	0.10	-	0.90	1.00	10.30	1.00	-	0.50	-	-
Total	606.70	677.30	463.50	132.70	151.40	791.60	289.20	264.90	948.70	122.30

Appendix 3: Continued

Species	11	12	13	14	15	16	17	18	19	20
Arrowtooth flounder	65.80	3.00	24.70	0.80	-	-	-	-	2.70	22.10
Big skate	-	-	-	-	29.80	10.10	-	-	-	-
Bigfin eelpout	1.00	-	-	-	-	-	-	-	-	-
Black eelpout	-	6.00	-	-	-	-	-	-	-	-
Bocaccio	4.30	-	-	-	-	-	-	-	-	-
Canary rockfish	1.60	-	-	-	-	-	0.90	4.50	-	0.80
Curlfin sole	-	-	-	-	2.00	-	1.20	-	-	-
Darkblotched rockfish	-	-	3.10	-	-	-	-	-	-	-
Dover sole	74.10	57.20	14.50	52.50	-	-	-	-	1.10	3.60
English sole	0.80	-	-	111.40	3.10	-	-	-	5.10	-
Eulachon	-	-	-	-	-	-	-	-	-	-
Flathead sole	-	-	-	3.20	-	-	-	-	-	-
Greenstriped rockfish	-	-	-	-	-	-	-	1.10	-	0.40
Kelp greenling	-	-	-	-	-	-	-	-	-	0.70
Lingcod	-	-	6.40	-	-	-	-	-	1.50	-
Longnose skate	-	1.40	1.80	16.80	-	-	-	-	-	-
Longspine thornyhead	-	4.00	-	-	-	-	-	-	-	-
Pacific cod	-	-	-	-	-	-	-	-	0.30	0.50
Pacific hake	20.10	-	198.20	3.50	-	-	-	-	-	-
Pacific halibut	-	-	12.00	4.40	34.60	20.90	12.90	-	8.50	-
Pacific ocean perch	59.10	-	180.20	-	-	-	-	-	-	-
Pacific sanddab	-	-	-	80.40	5.80	0.20	0.20	-	-	-
Petrale sole	21.70	-	-	13.00	12.90	0.90	1.30	-	-	-
Puget sound rockfish	-	-	-	-	-	-	-	-	7.70	-
Pygmy rockfish	-	-	-	-	-	-	-	-	105.80	-
Quillback rockfish	-	-	-	-	-	-	0.90	-	-	-
Redbanded rockfish	3.90	-	0.20	-	-	-	-	-	-	-
Redstripe rockfish	-	-	-	-	-	-	-	-	74.40	-
Rex sole	2.60	0.70	-	14.10	2.60	-	-	0.10	0.50	3.10
Rosethorn rockfish	-	-	2.70	-	-	-	-	1.10	-	0.30
Rougheye rockfish	202.30	-	0.10	-	-	-	-	-	-	-
Sablefish	15.60	174.70	4.50	0.30	-	-	-	-	-	-
Sandpaper skate	-	-	-	-	-	-	-	-	-	-
Sharpchin rockfish	-	-	-	-	-	-	-	-	-	-
Shortraker rockfish	6.30	-	-	-	-	-	-	-	-	-
Shortspine thornyhead	81.40	44.40	27.00	-	-	-	-	-	-	-
Silvergray rockfish	-	-	-	-	-	-	-	-	3.00	-
Slender sole	0.30	-	0.20	-	-	-	-	-	-	0.20
Southern rock sole	-	-	-	0.10	9.50	13.10	13.00	1.10	0.70	0.40
Spiny dogfish	13.50	-	-	47.90	68.20	62.80	83.80	33.60	814.60	14.70
Splitnose rockfish	58.20	-	25.20	-	-	-	-	-	-	-
Spotted ratfish	-	-	0.40	16.30	0.90	0.50	-	3.70	8.40	-
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	-	-	-	-	-	-	0.20
Walleye pollock	-	-	-	-	-	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	-	2.90	-	12.60	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	-	-	-	-	-	-	-	134.90	37.50	23.50
Other	2.90	17.90	18.20	1.50	-	-	0.15	1.70	2.70	-
Total	635.50	309.30	519.40	366.20	169.40	108.50	117.25	181.80	1087.10	70.50

Appendix 3: Continued

Species	21	22	23	24	25	26	27	28	29	30
Arrowtooth flounder	-	71.00	199.60	176.20	33.20	32.20	23.80	42.80	6.00	26.00
Big skate	-	-	-	-	-	-	-	-	-	-
Bigfin eelpout	-	-	-	-	-	1.30	-	0.80	2.30	-
Black eelpout	-	-	-	-	-	-	-	0.10	0.50	-
Bocaccio	-	-	-	-	-	-	-	-	-	-
Canary rockfish	2.00	-	8.00	10.60	-	-	-	-	-	5.20
Curlfin sole	-	-	-	-	-	-	-	-	-	-
Darkblotched rockfish	-	-	-	68.90	-	-	0.60	2.30	-	-
Dover sole	-	24.60	31.90	39.30	62.20	42.80	21.50	132.00	37.90	10.80
English sole	-	1.40	8.40	6.80	-	-	-	-	-	-
Eulachon	-	0.20	-	-	-	-	12.90	-	-	-
Flathead sole	-	0.60	1.40	0.90	-	1.70	1.80	-	-	-
Greenstriped rockfish	-	1.30	0.80	4.00	-	-	14.30	2.20	-	12.70
Kelp greenling	0.30	-	-	-	-	-	-	-	-	-
Lingcod	0.60	-	2.40	11.70	-	-	-	-	-	1.40
Longnose skate	-	5.10	-	8.20	5.80	9.10	7.70	3.40	10.60	16.80
Longspine thornyhead	-	-	-	-	-	-	-	-	-	-
Pacific cod	-	25.70	51.80	11.70	-	3.70	3.20	-	-	3.60
Pacific hake	-	-	-	-	8.00	-	-	7.60	4.20	5.70
Pacific halibut	-	7.20	-	-	4.30	-	-	-	-	-
Pacific ocean perch	-	0.20	0.80	378.60	-	287.50	5.20	176.90	18.40	884.60
Pacific sanddab	-	-	-	-	-	-	-	-	-	-
Petrale sole	-	-	1.50	2.50	-	-	-	-	-	-
Puget sound rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-	0.40	-	-	-
Quillback rockfish	-	-	-	-	-	-	-	-	-	-
Redbanded rockfish	-	-	-	1.90	-	5.20	2.30	2.00	-	20.50
Redstripe rockfish	-	-	-	-	-	-	-	-	-	-
Rex sole	0.50	13.30	30.70	44.60	14.00	19.10	53.90	4.10	6.70	5.80
Rosethorn rockfish	-	-	-	-	-	0.50	1.80	0.50	-	1.40
Rougheye rockfish	-	-	-	-	8.10	2.30	-	0.70	7.90	6.40
Sablefish	-	40.50	56.30	105.50	18.00	47.30	10.40	16.20	26.90	20.70
Sandpaper skate	-	-	-	-	2.60	0.90	-	0.90	1.30	1.40
Sharpchin rockfish	-	-	-	1.20	-	3.50	0.80	1.00	-	94.50
Shortraker rockfish	-	-	-	-	8.40	-	-	-	3.90	-
Shortspine thornyhead	-	-	-	0.40	15.80	22.60	-	20.00	12.00	4.60
Silvergray rockfish	-	-	-	-	-	-	-	-	-	21.00
Slender sole	-	2.40	7.80	4.10	-	1.70	3.10	2.10	0.60	0.50
Southern rock sole	1.10	-	-	-	-	-	-	-	-	-
Spiny dogfish	2.20	96.00	9.50	-	-	-	-	-	-	-
Splitnose rockfish	-	-	-	-	-	944.40	8.50	11.90	-	0.60
Spotted ratfish	-	2.70	0.60	6.50	-	3.60	1.20	4.10	-	3.40
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	-	-	-	0.40	0.10	-	-
Walleye pollock	-	-	-	-	5.40	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	-	-	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	18.40
Yellowtail rockfish	0.70	74.40	10.00	83.20	2.00	-	8.70	-	-	-
Other	1.50	1.30	2.00	0.90	23.80	1.60	6.90	3.90	6.00	0.90
Total	8.90	367.90	423.50	967.70	211.60	1431.00	189.40	435.60	145.20	1166.90

Appendix 3: Continued

Species	31	32	33	34	35	36	37	38	39	40
Arrowtooth flounder	3.70	30.30	107.20	50.10	16.60	22.70	25.10	17.80	177.40	139.00
Big skate	-	-	-	-	-	-	-	-	-	-
Bigfin eelpout	-	-	-	-	-	-	1.10	1.40	-	0.30
Black eelpout	-	-	-	-	1.00	-	-	-	-	-
Bocaccio	-	-	-	-	-	-	-	-	-	4.30
Canary rockfish	-	-	2.00	2.10	2.00	-	-	-	1.70	23.00
Curlfin sole	-	-	-	-	-	-	-	-	-	-
Darkblotched rockfish	-	-	-	-	-	12.50	8.60	2.90	-	-
Dover sole	2.70	26.30	96.90	53.30	42.10	24.90	14.60	13.50	19.10	18.20
English sole	36.50	0.90	2.90	-	-	3.30	-	-	7.90	10.20
Eulachon	-	0.50	-	0.30	-	-	-	-	-	0.50
Flathead sole	-	12.80	19.50	4.20	-	-	-	-	-	-
Greenstriped rockfish	-	-	2.30	20.00	4.60	-	0.80	-	1.70	10.90
Kelp greenling	-	-	-	-	-	-	-	-	-	-
Lingcod	16.40	-	-	23.80	-	-	-	-	2.30	36.50
Longnose skate	-	11.10	18.20	2.90	22.20	6.90	-	-	9.60	5.90
Longspine thornyhead	-	-	-	-	1.40	-	-	-	-	-
Pacific cod	0.20	0.60	9.80	27.70	-	-	-	-	14.60	10.90
Pacific hake	-	298.50	-	2.90	1.00	1.80	0.80	84.00	2.10	-
Pacific halibut	-	-	-	-	4.60	-	-	-	-	-
Pacific ocean perch	-	-	-	-	-	89.40	1046.80	56.70	-	-
Pacific sanddab	115.00	-	3.20	-	-	-	-	-	-	-
Petrale sole	4.70	-	0.80	-	-	-	-	-	1.90	16.20
Puget sound rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	1.30	-	-	-	-	-	0.40
Quillback rockfish	-	-	-	-	-	-	-	-	-	-
Redbanded rockfish	-	-	-	1.90	-	3.90	4.90	1.20	-	-
Redstripe rockfish	-	-	-	0.60	-	-	-	-	-	0.50
Rex sole	44.50	32.50	16.40	16.50	-	47.10	4.60	8.50	34.40	30.20
Rosethorn rockfish	-	-	-	1.80	-	-	1.00	-	-	1.50
Rougheye rockfish	-	-	-	-	4.60	3.30	-	71.10	-	-
Sablefish	-	11.70	17.10	5.60	46.00	5.10	19.00	25.10	18.70	61.60
Sandpaper skate	-	-	-	-	-	-	-	-	-	-
Sharpchin rockfish	-	-	0.10	7.10	-	6.30	2.40	-	-	5.60
Shortraker rockfish	-	-	-	-	3.30	-	-	-	-	-
Shortspine thornyhead	-	-	-	-	55.30	-	6.70	28.30	-	-
Silvergray rockfish	-	-	-	-	-	2.00	-	-	-	2.50
Slender sole	0.30	7.00	5.30	2.40	-	0.60	0.80	0.30	13.30	15.10
Southern rock sole	-	-	-	-	-	-	-	-	-	-
Spiny dogfish	69.40	59.80	192.60	29.50	-	-	-	-	17.10	40.50
Splitnose rockfish	-	-	-	-	1.00	138.00	166.90	4.70	-	-
Spotted ratfish	-	4.00	0.30	1.90	0.70	1.50	1.80	1.40	6.40	1.70
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	2.80	1.00	-	-	-	-	0.50
Walleye pollock	-	-	-	-	-	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	-	-	-	-	4.00
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	4.60	13.60	29.20	33.60	-	1.10	-	-	30.30	80.20
Other	0.40	2.40	1.90	6.90	8.90	3.50	1.60	3.80	2.50	0.30
Total	298.40	512.00	525.70	299.20	216.30	373.90	1307.50	320.70	361.00	520.50

Appendix 3: Continued

Species	41	42	43	44	45	46	47	48	49	50
Arrowtooth flounder	13.40	335.60	1178.60	226.40	92.40	654.35	1030.17	-	-	7.60
Big skate	-	-	-	-	-	-	-	2.30	14.40	2.70
Bigfin eelpout	-	-	-	-	-	-	-	-	-	-
Black eelpout	-	-	-	-	-	-	-	-	-	-
Bocaccio	242.70	22.00	8.90	-	-	10.20	-	-	-	-
Canary rockfish	215.70	4.70	10.90	8.40	5.10	10.35	-	-	-	-
Curlfin sole	-	-	-	-	-	-	-	1.20	0.50	-
Darkblotched rockfish	-	-	4.00	-	-	-	-	-	-	-
Dover sole	2.40	32.60	50.40	49.30	17.30	8.71	29.16	-	0.10	1.80
English sole	7.90	2.40	-	-	-	1.09	-	5.60	21.20	1.30
Eulachon	-	-	-	-	-	-	-	-	-	0.60
Flathead sole	-	30.50	4.90	0.70	-	-	-	0.04	-	20.20
Greenstriped rockfish	5.00	2.00	9.30	18.50	43.70	-	1.94	-	-	-
Kelp greenling	-	-	-	-	-	-	-	-	-	-
Lingcod	1050.7	-	5.40	-	-	-	-	3.00	31.20	2.60
Longnose skate	20.40	48.20	7.00	11.90	17.70	7.80	-	-	1.70	-
Longspine thornyhead	-	-	-	-	-	-	-	-	-	-
Pacific cod	-	2.30	2.00	4.20	2.20	3.80	-	-	-	-
Pacific hake	-	-	2.20	-	19.90	-	-	-	-	-
Pacific halibut	-	4.80	-	-	8.60	-	-	-	-	-
Pacific ocean perch	-	0.20	97.30	3.60	55.90	12.80	3770.82	-	-	-
Pacific sanddab	-	-	-	-	-	-	-	8.30	4.90	0.90
Petrale sole	26.20	7.40	-	-	-	3.00	-	0.70	12.70	2.80
Puget sound rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-	-	-	-	-
Quillback rockfish	-	-	-	-	-	-	-	-	-	-
Redbanded rockfish	-	-	76.50	84.30	12.90	1.91	31.10	-	-	-
Redstripe rockfish	-	-	-	417.90	10.20	344.74	-	-	-	-
Rex sole	3.60	71.20	111.30	117.00	77.60	33.77	9.72	0.10	0.50	34.40
Rosethorn rockfish	-	-	2.00	-	10.00	7.08	-	-	-	-
Rougheye rockfish	-	-	-	-	-	-	-	-	-	-
Sablefish	2.50	20.10	56.90	4.80	38.70	377.15	1836.82	-	-	-
Sandpaper skate	-	-	-	-	-	-	-	-	0.70	-
Sharpchin rockfish	0.50	-	149.70	13.40	20.30	53.37	27.21	-	-	-
Shortraker rockfish	-	-	-	-	-	-	-	-	-	-
Shortspine thornyhead	0.40	-	-	-	-	-	-	-	-	-
Silvergray rockfish	5.90	-	21.00	73.60	7.70	235.82	27.21	-	-	-
Slender sole	1.10	15.00	0.90	2.50	2.60	0.54	-	-	-	11.60
Southern rock sole	-	-	-	-	-	-	-	4.30	7.20	-
Spiny dogfish	15.90	-	-	5.80	27.20	16.07	-	-	-	97.80
Splitnose rockfish	-	-	-	-	1.00	-	-	-	-	-
Spotted ratfish	12.00	4.40	3.20	5.10	24.20	3.27	-	0.30	2.40	0.30
Stripetail rockfish	-	-	3.90	1.50	2.70	3.00	-	-	-	-
Threadfin sculpin	1.70	0.10	0.60	-	-	-	-	-	-	-
Walleye pollock	-	-	-	-	-	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-	-	11.90	5.20	0.20
Wolf eel	-	-	-	-	-	-	-	-	-	-
Yelloweye rockfish	23.10	-	-	-	-	-	-	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	3.20	-	1.50	11.10	8.60	-	38.87	-	-	-
Other	1.00	1.90	0.60	1.50	2.40	1.36	0.97	1.10	0.40	1.30
Total	1655.3	605.40	1809.00	1061.50	508.90	1790.18	6803.99	38.84	103.10	186.10

Appendix 3: Continued

Species	51	52	53	54	55	56	57	58	59	60
Arrowtooth flounder	10.20	1.20	-	-	-	-	-	-	-	12.50
Big skate	-	-	11.30	1.90	-	-	3.90	2.50	-	-
Bigfin eelpout	-	-	-	-	-	-	-	-	-	-
Black eelpout	-	-	-	-	-	-	-	-	-	-
Bocaccio	-	-	-	-	-	-	-	-	-	-
Canary rockfish	31.00	3.50	2.40	-	3.40	-	-	-	-	80.80
Curlfin sole	-	-	-	-	0.50	11.20	7.10	7.40	2.60	-
Darkblotched rockfish	-	-	-	-	-	-	-	-	-	-
Dover sole	1.00	3.30	4.80	3.30	-	-	-	-	-	70.10
English sole	3.00	4.40	61.90	18.30	-	3.20	8.30	6.90	16.80	2.90
Eulachon	1.40	0.20	-	-	-	-	-	-	0.10	-
Flathead sole	2.80	8.60	-	-	-	-	-	-	-	-
Greenstriped rockfish	-	-	-	-	-	-	-	-	-	1.10
Kelp greenling	-	-	-	0.20	-	-	-	-	-	-
Lingcod	10.40	17.70	-	25.00	-	3.90	-	-	4.00	4.00
Longnose skate	21.10	5.30	-	-	-	-	-	-	5.90	-
Longspine thornyhead	-	-	-	-	-	-	-	-	-	-
Pacific cod	11.40	13.80	0.30	-	-	-	-	-	-	26.90
Pacific hake	-	-	-	-	-	0.70	-	-	-	-
Pacific halibut	9.10	4.40	-	9.50	-	2.00	-	-	7.50	-
Pacific ocean perch	-	-	-	-	-	-	-	-	-	3.70
Pacific sanddab	24.80	74.40	8.10	44.00	-	19.20	12.50	15.10	15.50	-
Petrale sole	6.50	1.20	1.70	0.60	-	0.70	0.06	-	0.10	0.60
Puget sound rockfish	-	-	1.20	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-	-	-	-	-
Quillback rockfish	-	-	2.90	-	0.10	-	-	-	-	-
Redbanded rockfish	-	-	-	-	-	-	-	-	-	-
Redstripe rockfish	-	-	-	-	-	-	-	-	-	23.30
Rex sole	8.50	53.30	24.60	48.50	-	3.60	4.70	3.00	7.20	31.00
Rosethorn rockfish	-	-	-	-	-	-	-	-	-	-
Rougheye rockfish	-	-	-	-	-	-	-	-	-	-
Sablefish	3.20	-	-	-	-	-	-	-	-	5.00
Sandpaper skate	-	-	-	-	-	-	-	-	-	-
Sharpchin rockfish	-	-	0.50	-	-	-	-	-	-	68.70
Shortraker rockfish	-	-	-	-	-	-	-	-	-	-
Shortspine thornyhead	-	-	-	-	-	-	-	-	-	-
Silvergray rockfish	-	-	-	-	-	-	-	-	-	80.20
Slender sole	3.10	7.70	0.30	-	-	-	-	-	-	3.70
Southern rock sole	-	0.50	0.30	0.90	0.90	12.10	13.80	22.20	5.10	-
Spiny dogfish	138.90	23.80	5.80	41.40	-	29.90	-	4.90	-	391.40
Splitnose rockfish	-	-	-	-	-	-	-	-	-	-
Spotted ratfish	0.40	2.70	4.80	-	0.20	0.70	2.10	2.90	0.50	1.00
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	-	-	-	-	-	-	-
Walleye pollock	4.00	0.40	-	-	-	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	6.20	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	-	-	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	2.10	-	13.80	0.30	0.10	-	-	-	-	-
Other	3.20	2.20	3.00	0.40	3.20	1.80	1.10	1.80	1.70	5.10
Total	296.10	228.60	147.70	194.30	8.40	95.20	53.56	66.70	67.00	812.00

Appendix 3: Continued

Species	61	62	63	64	65	66	67	68	69	70
Arrowtooth flounder	3.90	416.00	98.80	47.50	10.40	68.80	25.70	58.40	-	-
Big skate	-	-	-	-	-	-	-	-	-	-
Bigfin eelpout	0.20	-	-	-	-	-	-	-	-	-
Black eelpout	-	-	0.40	-	-	-	-	-	-	-
Bocaccio	7.00	5.50	-	2.70	-	4.10	-	-	-	-
Canary rockfish	14.20	-	-	14.50	6.80	36.30	1.80	1.60	-	-
Curlfin sole	-	-	-	-	-	-	-	-	-	-
Darkblotched rockfish	-	-	9.30	0.30	-	-	-	-	-	-
Dover sole	7.50	19.90	65.40	65.20	2.10	7.70	13.20	57.30	-	-
English sole	0.30	-	-	2.30	-	-	33.10	40.60	3.50	-
Eulachon	-	-	-	-	-	-	-	-	-	-
Flathead sole	1.00	-	-	-	0.80	0.20	0.30	0.20	-	-
Greenstriped rockfish	1.00	4.10	-	3.60	1.20	25.60	-	0.10	-	-
Kelp greenling	-	-	-	-	-	-	-	-	-	-
Lingcod	3.00	5.80	-	-	-	-	2.90	12.80	-	13.40
Longnose skate	-	-	15.80	15.80	-	-	-	0.30	-	-
Longspine thornyhead	-	-	-	-	-	-	-	-	-	-
Pacific cod	20.60	55.30	-	13.30	-	6.10	1.20	16.00	-	-
Pacific hake	-	-	5.20	85.50	-	-	-	-	-	-
Pacific halibut	-	-	-	-	-	4.10	2.80	4.10	4.70	5.00
Pacific ocean perch	0.20	189.00	43.50	8.30	1.00	0.60	-	-	-	-
Pacific sanddab	-	-	-	15.00	-	-	-	-	8.80	1.00
Petrale sole	-	-	-	0.60	-	-	4.60	17.60	-	-
Puget sound rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-	-	-	-	-
Quillback rockfish	-	-	-	-	-	-	-	-	-	1.60
Redbanded rockfish	5.50	16.70	4.30	1.80	5.60	11.90	-	-	-	-
Redstripe rockfish	0.90	18.70	-	43.30	28.80	1.00	-	-	-	-
Rex sole	30.50	11.20	3.30	43.00	-	7.70	26.40	44.10	-	-
Rosethorn rockfish	-	1.30	-	-	2.10	6.20	-	0.90	-	-
Rougheye rockfish	-	-	15.60	4.50	-	-	-	-	-	-
Sablefish	-	14.90	80.80	8.70	-	-	17.20	16.80	-	-
Sandpaper skate	-	-	1.00	-	-	-	-	-	-	-
Sharpchin rockfish	2.10	194.30	5.80	0.90	45.60	9.60	-	0.70	-	-
Shortraker rockfish	-	-	4.70	-	-	-	-	-	-	-
Shortspine thornyhead	-	4.30	20.00	1.20	-	-	-	-	-	-
Silvergray rockfish	50.40	16.30	-	6.30	12.20	27.50	14.60	9.50	-	-
Slender sole	5.60	-	-	8.30	0.50	1.50	0.90	3.50	-	-
Southern rock sole	-	-	-	-	-	-	-	-	4.60	2.90
Spiny dogfish	91.30	36.80	1.60	26.70	-	40.10	105.20	429.70	6.30	-
Splitnose rockfish	-	-	2.20	-	0.60	-	-	-	-	-
Spotted ratfish	2.20	0.90	1.80	-	1.30	1.80	1.70	1.40	3.60	7.90
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	-	-	-	-	-	-	-
Walleye pollock	0.30	-	-	3.60	-	1.40	-	0.10	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	3.90
Yelloweye rockfish	-	-	-	-	10.60	15.30	-	-	-	-
Yellowmouth rockfish	-	48.10	-	-	-	-	-	-	-	-
Yellowtail rockfish	-	5.50	-	3.00	-	-	-	-	-	-
Other	1.20	1.70	6.40	4.90	1.30	1.40	0.10	0.60	0.20	-
Total	248.90	1066.30	385.90	430.80	130.90	278.90	251.70	716.30	31.70	35.70

Appendix 3: Continued

Species	71	72	73	74	75	76	77	78	79	80
Arrowtooth flounder	-	0.10	0.10	-	57.10	204.80	1740.40	-	331.00	90.70
Big skate	-	-	47.30	-	-	-	-	-	-	-
Bigfin eelpout	-	-	-	-	-	-	-	-	-	-
Black eelpout	-	-	-	-	-	-	-	-	-	-
Bocaccio	-	-	-	-	3.90	12.40	-	-	-	-
Canary rockfish	-	-	-	-	-	3.30	20.60	-	-	-
Curlfin sole	-	2.90	5.00	-	-	-	-	-	-	-
Darkblotched rockfish	-	-	-	-	-	-	-	-	1.80	4.30
Dover sole	-	-	-	-	7.00	1.90	25.60	9.20	10.00	53.40
English sole	-	2.20	2.90	-	16.40	0.70	-	-	-	-
Eulachon	-	-	-	-	-	-	-	-	-	-
Flathead sole	-	-	-	-	2.50	0.70	-	-	-	-
Greenstriped rockfish	-	-	-	-	0.30	-	0.50	-	-	-
Kelp greenling	0.40	-	-	-	-	-	-	-	-	-
Lingcod	6.30	-	-	-	4.30	173.70	32.20	-	23.20	-
Longnose skate	-	9.90	-	-	4.60	23.20	46.10	-	-	-
Longspine thornyhead	-	-	-	-	-	-	-	12.70	-	-
Pacific cod	-	0.20	-	-	113.30	2.90	-	-	2.40	-
Pacific hake	-	-	-	-	1.20	-	-	2.20	1.40	25.60
Pacific halibut	30.30	15.60	5.90	-	-	-	-	-	-	-
Pacific ocean perch	-	-	-	-	-	-	-	-	650.20	33.60
Pacific sanddab	0.80	13.90	31.50	-	35.80	0.40	-	-	-	-
Petrale sole	-	2.00	0.20	-	0.30	0.50	0.50	-	-	-
Puget sound rockfish	0.90	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-	-	-	-	-
Quillback rockfish	10.30	1.70	-	-	-	-	-	-	-	-
Redbanded rockfish	-	-	-	-	-	-	-	-	25.20	14.40
Redstripe rockfish	-	-	-	-	-	68.50	-	-	-	-
Rex sole	-	0.30	-	-	30.80	1.50	1.20	-	11.30	10.30
Rosethorn rockfish	-	-	-	-	-	-	-	-	0.10	-
Rougheye rockfish	-	-	-	-	-	-	-	-	-	109.90
Sablefish	-	-	-	-	10.80	-	7.90	15.40	1322.70	24.30
Sandpaper skate	-	-	-	-	-	-	-	-	-	-
Sharpchin rockfish	-	-	-	-	-	-	0.10	-	2.50	-
Shortraker rockfish	-	-	-	-	-	-	-	-	-	32.10
Shortspine thornyhead	-	-	-	-	-	-	-	9.80	-	8.00
Silvergray rockfish	-	-	-	-	-	30.80	-	-	4.70	-
Slender sole	-	-	-	-	1.40	-	-	-	-	-
Southern rock sole	5.70	15.60	28.80	-	-	-	-	-	-	-
Spiny dogfish	-	-	-	49.60	468.40	178.80	27.50	-	-	-
Splitnose rockfish	-	-	-	-	-	-	-	-	0.20	-
Spotted ratfish	8.20	9.60	15.30	0.70	-	3.40	30.40	-	1.70	1.10
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	-	-	-	-	0.20	-	-
Walleye pollock	-	0.20	-	-	0.30	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	47.20	2.20	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	-	-	-	-	-	64.30	-	-	12.00	-
Other	-	3.50	0.20	-	5.80	0.30	2.30	5.20	-	5.10
Total	62.90	77.70	137.20	50.30	764.20	819.30	1937.50	54.70	2400.40	412.80

Appendix 3: Continued

Species	81	82	83	84	85	86	87	88	89	90
Arrowtooth flounder	98.20	-	43.30	-	1118.90	27.10	-	15.50	12.70	-
Big skate	-	-	-	-	-	-	-	-	-	-
Bigfin eelpout	-	-	-	0.20	-	-	-	-	-	-
Black eelpout	-	-	-	-	-	-	-	-	-	-
Bocaccio	-	-	-	-	-	-	-	-	-	-
Canary rockfish	-	-	-	-	3.00	51.00	-	-	-	-
Curlfin sole	-	-	-	-	-	-	0.60	-	-	-
Darkblotched rockfish	12.60	-	-	8.90	-	-	-	-	-	-
Dover sole	50.10	1.20	4.00	15.30	15.30	0.50	0.20	92.50	83.30	52.70
English sole	-	1.20	0.50	0.30	61.20	5.00	0.90	45.40	3.50	-
Eulachon	-	2.80	8.50	-	-	-	-	0.50	-	-
Flathead sole	-	0.40	6.50	-	1.00	-	-	3.30	3.00	15.10
Greenstriped rockfish	-	0.20	1.20	-	4.40	0.50	-	-	-	-
Kelp greenling	-	-	-	-	-	-	-	-	-	-
Lingcod	5.30	12.00	6.70	-	-	17.60	479.20	-	3.60	-
Longnose skate	19.30	23.00	-	-	-	-	5.00	18.40	19.60	17.00
Longspine thornyhead	-	-	-	-	-	-	-	-	-	-
Pacific cod	-	5.30	52.70	-	56.80	-	42.20	1.50	2.80	-
Pacific hake	4.50	-	-	36.60	-	-	-	58.40	140.20	192.00
Pacific halibut	-	3.30	-	-	-	-	205.40	-	-	-
Pacific ocean perch	999.40	-	-	290.90	-	-	-	-	-	-
Pacific sanddab	-	24.80	0.90	-	-	-	32.00	-	-	-
Petrale sole	-	3.50	1.30	-	5.30	0.90	73.50	-	-	1.60
Puget sound rockfish	-	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-	-	-	-	-
Quillback rockfish	-	-	-	-	-	-	-	-	-	-
Redbanded rockfish	28.00	-	-	10.80	-	-	-	-	-	1.10
Redstripe rockfish	-	-	-	-	-	-	-	-	-	-
Rex sole	34.40	11.90	30.80	19.00	21.40	6.10	-	11.80	12.90	47.30
Rosethorn rockfish	-	-	-	4.20	-	-	-	-	-	-
Rougheye rockfish	-	-	-	0.50	-	-	-	-	-	-
Sablefish	166.40	1.10	1.10	13.40	236.80	-	-	5.50	-	-
Sandpaper skate	-	-	-	0.30	-	-	-	-	-	1.30
Sharpchin rockfish	2.20	-	-	-	-	-	-	-	-	-
Shortraker rockfish	-	-	-	-	-	-	-	-	-	-
Shortspine thornyhead	0.40	-	-	48.80	-	-	-	-	-	-
Silvergray rockfish	4.20	-	-	-	-	-	-	-	-	-
Slender sole	0.30	1.00	8.70	0.70	3.20	0.60	-	0.10	0.20	0.90
Southern rock sole	-	-	-	-	-	-	41.40	-	-	-
Spiny dogfish	5.20	190.80	50.40	-	16.70	14.40	3726.00	75.80	67.60	49.50
Splitnose rockfish	22.40	-	-	39.10	-	-	-	-	0.05	-
Spotted ratfish	1.60	-	-	-	-	2.90	0.80	12.00	27.20	32.70
Stripetail rockfish	3.50	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	-	-	0.10	0.10	-	-	-
Walleye pollock	-	0.60	-	-	-	-	-	15.70	14.90	27.60
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	3.60	-	-	-
Yelloweye rockfish	-	-	-	-	-	6.20	-	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	2.30	-	3.50	-	-	-	-	-	-	-
Other	-	0.90	1.20	0.60	-	1.00	-	1.60	0.50	1.00
Total	1460.3	284.00	221.30	489.60	1544.00	133.90	4610.90	358.00	392.05	439.80

Appendix 3: Continued

Species	91	92	93	94	95	96	97	98	99	100
Arrowtooth flounder	-	22.80	8.10	5.00	-	-	38.40	70.70	33.40	51.40
Big skate	-	8.50	-	-	28.60	-	-	-	-	-
Bigfin eelpout	-	-	-	-	-	-	1.00	-	-	-
Black eelpout	-	-	-	-	-	-	-	-	-	-
Bocaccio	-	-	-	-	-	-	-	-	-	-
Canary rockfish	1.60	-	-	-	-	-	-	10.50	2.80	15.00
Curlfin sole	-	-	-	-	-	-	-	-	-	-
Darkblotched rockfish	-	-	-	-	-	-	-	-	-	-
Dover sole	-	100.30	12.60	41.00	-	1.70	170.60	51.10	14.20	145.90
English sole	-	185.10	85.70	28.90	-	2.70	0.70	-	-	4.00
Eulachon	-	0.70	570.60	-	-	-	-	-	-	-
Flathead sole	-	87.80	5.90	5.60	-	-	18.90	1.50	0.50	8.10
Greenstriped rockfish	-	-	-	-	-	-	-	-	-	2.90
Kelp greenling	2.00	-	-	-	-	7.30	-	-	-	-
Lingcod	1.70	-	-	-	-	9.60	-	-	2.00	-
Longnose skate	8.60	9.90	2.40	-	-	-	40.10	17.90	9.20	10.50
Longspine thornyhead	-	-	-	-	-	-	-	-	-	-
Pacific cod	-	7.80	4.10	2.30	21.30	56.90	17.70	44.80	64.30	2.70
Pacific hake	-	94.60	-	8.90	-	447.70	142.60	39.40	3.30	43.90
Pacific halibut	-	-	-	-	9.40	14.70	-	-	106.50	-
Pacific ocean perch	-	-	-	-	-	-	-	-	-	-
Pacific sanddab	-	0.80	6.00	1.30	3.90	120.20	7.30	0.40	0.30	-
Petrale sole	-	1.10	1.70	-	-	3.60	-	0.70	3.40	-
Puget sound rockfish	0.20	-	-	-	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-	-	-	-	-
Quillback rockfish	14.40	-	-	-	-	19.60	1.20	-	-	-
Redbanded rockfish	-	-	-	-	-	-	-	-	-	-
Redstripe rockfish	0.40	-	-	-	-	14.80	-	-	-	-
Rex sole	-	30.50	12.40	19.30	1.80	-	50.30	36.90	2.80	51.50
Rosethorn rockfish	-	-	-	-	-	-	-	-	-	-
Rougheye rockfish	-	-	-	-	-	-	-	-	-	-
Sablefish	-	2.30	0.60	1.90	-	3.00	26.60	29.50	-	32.30
Sandpaper skate	-	-	-	-	-	-	1.20	-	-	-
Sharpchin rockfish	-	-	-	-	-	-	-	-	-	-
Shortraker rockfish	-	-	-	-	-	-	-	-	-	-
Shortspine thornyhead	-	-	-	-	-	-	-	-	-	-
Silvergray rockfish	-	-	-	-	-	-	-	-	-	-
Slender sole	-	1.40	-	-	-	-	5.20	1.60	0.50	5.60
Southern rock sole	0.60	-	-	-	10.70	18.70	-	-	15.80	-
Spiny dogfish	16.20	126.20	1.00	2.70	1107.90	913.90	153.50	30.60	411.90	70.90
Splitnose rockfish	-	-	-	-	-	-	-	-	-	-
Spotted ratfish	9.10	163.80	2.40	15.90	42.00	86.60	30.70	18.40	53.90	9.80
Stripetail rockfish	-	-	-	-	-	-	-	-	-	-
Threadfin sculpin	-	-	-	-	-	2.90	-	-	-	-
Walleye pollock	-	7.10	8.70	2.20	-	-	1.10	12.00	-	-
Whitebait smelt	-	-	-	-	-	-	-	-	-	-
Wolf eel	-	-	-	-	-	-	-	-	-	-
Yelloweye rockfish	-	-	-	-	-	-	-	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-	-	-	-	-
Yellowtail rockfish	9.30	-	-	-	-	40.50	-	2.10	6.60	8.00
Other	2.20	1.10	4.60	0.60	3.20	0.60	4.40	0.20	-	0.70
Total	66.30	851.80	726.80	135.60	1228.80	1765.00	711.50	368.30	731.40	463.20

Appendix 3: Continued

Species	101	102	103	104	105	106
Arrowtooth flounder	38.70	25.80	19.60	108.10	40.10	31.00
Big skate	-	-	-	-	-	-
Bigfin eelpout	-	-	-	-	-	-
Black eelpout	-	-	-	-	-	-
Bocaccio	-	-	-	-	-	-
Canary rockfish	-	36.90	9.20	38.50	9.00	1.60
Curlfin sole	-	-	-	-	-	-
Darkblotched rockfish	-	-	-	-	1.20	-
Dover sole	66.20	48.80	64.40	16.40	131.60	12.50
English sole	0.70	1.80	1.90	21.80	2.40	4.20
Eulachon	-	-	-	-	-	-
Flathead sole	5.10	1.40	11.00	1.60	1.90	0.50
Greenstriped rockfish	-	1.00	2.00	4.20	-	4.30
Kelp greenling	-	-	-	-	-	-
Lingcod	-	28.10	-	-	-	-
Longnose skate	19.40	19.90	-	1.20	-	-
Longspine thornyhead	-	-	-	-	-	-
Pacific cod	1.90	33.90	-	5.90	16.60	5.30
Pacific hake	25.90	49.10	21.40	-	2.10	-
Pacific halibut	-	-	-	-	-	-
Pacific ocean perch	-	-	-	1.30	-	9.60
Pacific sanddab	-	0.30	-	0.20	-	0.30
Petrale sole	-	18.00	-	-	0.90	2.50
Puget sound rockfish	-	-	-	-	-	-
Pygmy rockfish	-	-	-	-	-	-
Quillback rockfish	-	-	-	-	-	-
Redbanded rockfish	-	-	-	-	2.40	-
Redstripe rockfish	-	-	3.20	4.50	0.50	-
Rex sole	40.30	16.10	63.80	20.80	150.10	27.30
Rosethorn rockfish	-	-	-	-	-	-
Rougheye rockfish	0.80	-	-	-	-	-
Sablefish	23.20	-	8.90	33.50	17.20	1.00
Sandpaper skate	-	-	-	-	0.10	-
Sharpchin rockfish	-	-	-	-	-	0.30
Shortraker rockfish	-	-	-	-	-	-
Shortspine thornyhead	-	-	-	-	-	-
Silvergray rockfish	-	-	-	-	-	-
Slender sole	11.50	1.50	1.90	11.20	4.60	3.40
Southern rock sole	-	-	-	-	-	-
Spiny dogfish	47.90	298.00	46.80	71.70	44.20	75.60
Splitnose rockfish	-	-	-	-	-	-
Spotted ratfish	35.90	7.60	3.70	0.20	8.60	8.30
Stripetail rockfish	-	-	-	-	0.20	-
Threadfin sculpin	-	0.40	-	0.30	-	2.10
Walleye pollock	-	-	-	-	-	-
Whitebait smelt	-	-	-	-	-	-
Wolf eel	-	-	-	-	0.20	-
Yelloweye rockfish	-	-	-	-	-	-
Yellowmouth rockfish	-	-	-	-	-	-
Yellowtail rockfish	-	3.10	9.80	13.80	1.10	5.40
Other	18.70	0.20	-	0.10	3.10	-
Total	336.20	591.90	267.60	355.30	438.10	195.20

Appendix 4: Alphabetical listing of all species captured. Catch weight in kilograms, trace indicates that no single catch of that species was greater than .1 kg.

Species common name	Species latin name	Occurrence	Total Catch weight (kg)
American shad	*Alosa sapidissima*	5	1.3
Anemone	*Actiniaria*	17	8.4
Armoured sea cucumber	*Psolus chitonoides*	1	Trace
Arrowtooth flounder	*Atheresthes stomias*	77	10,287.42
Ascidians and tunicates	*Ascidiacea*	1	Trace
Basket stars	*Euryalina*	12	4.5
Big skate	*Raja binoculata*	14	200.6
Bigeye poacher	*Bathyagonus pentacanthus*	1	Trace
Bigfin eelpout	*Lycodes cortezianus*	12	9.6
Black eelpout	*Lycodes diapterus*	8	9.7
Black hagfish	*Eptatretus deani*	2	0.7
Blackbelly eelpout	*Lycodes pacificus*	24	7.5
Blackfin poacher	*Bathyagonus nigripinnis*	3	Trace
Blackmouth eelpout	*Lycodapus fierasfer*	1	Trace
Blacktail snailfish	*Careproctus melanurus*	1	0.3
Blacktip poacher	*Xeneretmus latifrons*	1	Trace
Blue lanternfish	*Tarletonbeania crenularis*	1	Trace
Bocaccio	*Sebastes paucispinis*	13	357.2
Broadfin snailfish	*Paraliparis ulochir*	1	Trace
Brown box crab	*Lopholithodes foraminatus*	2	0.7
Brown cat shark	*Apristurus brunneus*	5	8.3
Buccinidae	*Buccinidae*	1	Trace
Butter sole	*Isopsetta isolepis*	1	Trace
California headlightfish	*Diaphus theta*	2	Trace
California tonguefish	*Symphurus atricaudus*	1	2.4
Canary rockfish	*Sebastes pinniger*	45	753.65
China rockfish	*Sebastes nebulosus*	1	0.8
Chinook salmon	*Oncorhynchus tshawytscha*	3	12.9
Copper rockfish	*Sebastes caurinus*	1	0.6
Crangons	*Crangon*	1	Trace
Curlfin sole	*Pleuronichthys decurrens*	13	44.1
Cushion star	*Pteraster tesselatus*	1	0.5
Darkblotched rockfish	*Sebastes crameri*	15	141.3
Darkfin sculpin	*Malacocottus zonurus*	2	Trace
Dover sole	*Microstomus pacificus*	83	2,900.27
English sole	*Parophrys vetulus*	63	1,218.69
Eulachon	*Thaleichthys pacificus*	24	599.8
Fish-eating star	*Stylasterias forreri*	11	0.6
Flapjack devilfish	*Opisthoteuthis californiana*	1	0.9
Flathead sole	*Hippoglossoides elassodon*	45	326.14
Fragile urchin	*Allocentrotus fragilis*	35	29.7
Gastropods	*Gastropoda*	1	Trace

Appendix 4: Continued

Species common name	Species latin name	Occurrence	Total Catch weight (kg)
Giant barnacle	*Balanus nubilis*	1	Trace
Giant grenadier	*Albatrossia pectoralis*	3	3.5
Giant red sea cucumber	*Parastichopus californicus*	9	4.3
Glass shrimp	*Pasiphaea pacifica*	2	1.3
Glass sponges	*Hexactinellida*	2	18.4
Graceful decorator crab	*Oregonia gracilis*	1	Trace
Greenstriped rockfish	*Sebastes elongatus*	47	268.04
Grenadiers	*Macrouridae*	1	Trace
Grooved tanner crab	*Chionoecetes tanneri*	5	6.6
Heart urchins	*Atelostomata*	4	17.5
Humpback snailfish	*Elassodiscus caudatus*	1	Trace
Inshore tanner crab	*Chionoecetes bairdi*	1	Trace
Jellyfish	*Scyphozoa*	10	2.2
Kelp greenling	*Hexagrammos decagrammus*	9	16.7
Lanternfishes	*Myctophidae*	1	Trace
Lingcod	*Ophiodon elongatus*	47	2,199.30
Long-armed sea star	*Orthasterias koehleri*	1	Trace
Longnose skate	*Raja rhina*	55	689.1
Longspine thornyhead	*Sebastolobus altivelis*	4	23.5
Longtailed pentamera	*Pentamera pseudocalcigera*	1	Trace
Looseskin eelpout	*Lycodapus dermatinus*	1	Trace
Luidiidae	*Luidiidae*	1	Trace
Metridium	*Metridium*	4	1.8
Mud star	*Ctenodiscus crispatus*	3	Trace
Neptuneidae	*Neptuneidae*	1	Trace
Northern lampfish	*Stenobrachius leucopsarus*	2	Trace
Northern ronquil	*Ronquilus jordani*	4	0.1
Octopus	*Octopus*	1	Trace
Opalescent inshore squid	*Loligo opalescens*	5	0.3
Oregontriton	*Fusitriton oregonensis*	5	0.5
Pacific bobtail squid	*Rossia pacifica*	3	Trace
Pacific cod	*Gadus macrocephalus*	63	980.9
Pacific flatnose	*Antimora microlepis*	4	1.8
Pacific grenadier	*Coryphaenoides acrolepis*	2	0.4
Pacific hake	*Merluccius productus*	46	2,436.40
Pacific halibut	*Hippoglossus stenolepis*	35	701.3
Pacific herring	*Clupea pallasi*	16	6.1
Pacific ocean perch	*Sebastes alutus*	36	9,357.62
Pacific red octopus	*Octopus rubescens*	2	Trace
Pacific sand lance	*Ammodytes hexapterus*	1	0.2
Pacific sanddab	*Citharichthys sordidus*	41	755.9
Pacific sardine	*Sardinops sagax*	8	2.9
Pacific tomcod	*Microgadus proximus*	10	0.8
Pallid slipskin	*Lycodapus mandibularis*	4	Trace
Peanutworms	*Sipuncula*	2	Trace
Petrale sole	*Eopsetta jordani*	54	313.06
Phrynophiurida	*Phrynophiurida*	8	1

Appendix 4: Continued

Species common name	Species latin name	Occurrence	Total Catch weight (kg)
Pile perch	*Rhacochilus vacca*	2	0.1
Pink shrimp (smooth)	*Pandalus jordani*	19	6.4
Poachers	*Agonidae*	2	Trace
Polychaete worms	*Polychaeta*	1	Trace
Poraniopsis inflata	*Poraniopsis inflata*	1	Trace
Prawn	*Pandalus platyceros*	27	13.23
Pseudarchaster alascensis	*Pseudarchaster alascensis*	1	Trace
Psolidae	*Psolidae*	1	Trace
Pterasteridae	*Pterasteridae*	3	0.5
Puget sound rockfish	*Sebastes emphaeus*	6	10
Purple sea urchins	*Strongylocentrotus purpuratus*	1	0.2
Pygmy rockfish	*Sebastes wilsoni*	6	108.4
Quillback rockfish	*Sebastes maliger*	10	63.1
Redbanded rockfish	*Sebastes babcocki*	29	385.71
Redstripe rockfish	*Sebastes proriger*	21	1,060.44
Rex sole	*Glyptocephalus zachirus*	87	2,106.29
Robust clubhook squid	*Moroteuthis robusta*	2	8.2
Rose starfish	*Crossaster papposus*	3	Trace
Rosethorn rockfish	*Sebastes helvomaculatus*	22	87.48
Roughback sculpin	*Chitonotus pugetensis*	2	Trace
Rougheye rockfish	*Sebastes aleutianus*	17	440.7
Sablefish	*Anoplopoma fimbria*	64	5,899.77
Sand sole	*Psettichthys melanostictus*	3	3.6
Sand star	*Luidia foliolata*	9	0.4
Sandpaper skate	*Bathyraja interrupta*	11	11.7
Scallop	*Pectinidae*	1	Trace
Schoolmaster gonate squid	*Berryteuthis magister*	15	37.3
Scorpionfishes	*Scorpaenidae*	1	3.7
Sea cucumber	*Holothuroidea*	10	3.05
Sea lilies and feather stars	*Crinoidea*	1	Trace
Sea mouse	*Aphrodita*	2	Trace
Sea pens	*Pennatulacea*	2	Trace
Sea urchins	*Echinacea*	2	0.8
Sea whip	*Osteocella septentrionalis*	5	Trace
Seaslugs	*Nudibranchia*	2	Trace
Sharpchin rockfish	*Sebastes zacentrus*	33	747.98
Shiner perch	*Cymatogaster aggregata*	5	0.5
Shortraker rockfish	*Sebastes borealis*	7	67.3
Shortspine thornyhead	*Sebastolobus alascanus*	22	449.6
Sidestripe shrimp	*Pandalopsis dispar*	14	2.1
Silvergray rockfish	*Sebastes brevispinis*	24	685.93
Slender sole	*Lyopsetta exilis*	63	207.24
Slim sculpin	*Radulinus asprellus*	4	Trace
Smootheye poacher	*Xeneretmus leiops*	6	Trace
Snailfishes	*Liparinae*	1	Trace
Snake prickleback	*Lumpenus sagitta*	2	0.1
Solasteridae	*Solasteridae*	6	0.6

Appendix 4: Continued

Species common name	Species latin name	Occurrence	Total Catch weight (kg)
Southern rock sole	*Lepidopsetta bilineata*	30	252
Spiny dogfish	*Squalus acanthias*	74	12,572.17
Spiny red sea star	*Hippasteria spinosa*	4	0.9
Spiny scallop	*Chlamys hastata*	2	Trace
Splitnose rockfish	*Sebastes diploproa*	19	1,427.65
Sponges	*Porifera*	7	4.4
Spotted ratfish	*Hydrolagus colliei*	87	975.37
Squids	*Teuthoidea*	2	2.1
Starfish	*Asteroidea*	4	0.6
Starry flounder	*Platichthys stellatus*	1	1.7
Stripetail rockfish	*Sebastes saxicola*	6	14.8
Sturgeon poacher	*Podothecus accipenserinus*	5	0.1
Sunflower starfish	*Pycnopodia helianthoides*	5	8.8
Sweet potato sea cucumber	*Molpadia intermedia*	1	Trace
Thornback sculpin	*Paricelinus hopliticus*	1	Trace
Threadfin sculpin	*Icelinus filamentosus*	21	16.8
Tiger rockfish	*Sebastes nigrocinctus*	1	1.5
Twoline eelpout	*Bothrocara brunneum*	2	5.1
Vampire squid	*Vampyroteuthis infernalis*	1	0.2
Vermilion rockfish	*Sebastes miniatus*	1	1.7
Vermillion starfish	*Mediaster aequalis*	2	Trace
Walleye pollock	*Theragra chalcogramma*	22	453.1
Whitebait smelt	*Allosmerus elongatus*	4	17.3
Whitebarred prickleback	*Poroclinus rothrocki*	1	Trace
Whitespotted sea cucumber	*Parastichopus leukothele*	11	3.8
Widow rockfish	*Sebastes entomelas*	2	1.1
Wolf eel	*Anarrhichthys ocellatus*	4	13.9
Yelloweye rockfish	*Sebastes ruberrimus*	14	241.9
Yellowmouth rockfish	*Sebastes reedi*	2	66.5
Yellowtail rockfish	*Sebastes flavidus*	43	852.97

Appendix 5: Average sensor data by tow for usable tows.

	Sounder GPS					BCS	SBE 39		Furuno FS20			Simrad ITI			Main Warp Scope	
Set	Bottom Depth (m)	Direction	Latitude	Longitude	Speed (km/h)	Tilt Angle	Depth (m)	Temp (C)	Trawl Depth (m)	Trawl Height (m)	Trawl Width (m)	Trawl Depth (m)	Trawl Height (m)	Trawl Width (m)	Length (m)	Ratio
1	89.0	44.2	48.540	124.876	5.2		93.3	7.3		4.0	10.1	91.0	3.7	14.5	250.0	2.68
2	86.0	147.6	48.613	125.072	6.3	25.3	87.8	7.5		4.5	10.1	86.0	4.0	12.3	175.0	1.99
3	99.0	272.0	48.607	125.129	5.4		101.1	7.3		4.4	9.9	99.0	4.1	13.3	200.0	1.98
4	72.3	326.8	48.686	125.197	5.2		74.0	7.9		5.0	9.3	72.7	4.1	13.0	150.0	2.03
5	473.0	105.0	48.220	125.826	5.0		472.7	5.2	456.0	5.1	10.4	445.7	4.5	12.5	866.7	1.83
6	171.0	305.5	48.312	125.806	5.6		174.9	7.0	173.0	4.9	9.3		4.8	14.5	375.0	2.14
7	139.3	235.4	48.285	125.649	6.1		141.3	7.0	139.7	5.2	9.9		4.7	14.0	350.0	2.48
9	140.7	13.0	48.364	125.701	5.8		142.8	7.0	141.3	4.8	9.0		4.7	14.0	275.0	1.93
10	143.0	310.7	48.370	125.804	5.6		146.2	6.9	143.7	4.7	9.6	345.3	2.1	14.3	300.0	2.05
11		238.2	48.311	125.922	5.2		347.2	5.8								
12	562.0	238.0	48.368	125.964	4.8		576.9	4.6	571.7	5.0	10.1	570.3	5.5	15.7	950.0	1.65
13	279.3	336.3	48.433	126.142	5.4		285.8	6.0	283.0	4.6	9.9	278.7	4.8	12.7	625.0	2.19
14	117.7	83.0	48.734	125.804	4.8		120.2	8.1	119.3	4.6	9.4	115.0	4.3	13.0	200.0	1.66
15	68.7	25.0	48.664	125.863	6.0	46.4	70.1	7.7	69.0	4.5	8.8	62.7	4.3		150.0	2.14
16	60.0	132.9	48.640	125.780	5.4	61.2	61.9	7.9	60.3	4.6	8.9	57.7	4.5		150.0	2.42
17	77.7	158.0	48.553	125.864	5.2	45.0	79.1	7.7	78.0	4.7	8.3	76.7	4.4		150.0	1.90
19	96.3	130.9	48.494	125.822	5.9		97.4	7.3	97.0	5.3	10.0	96.0	4.9		225.0	2.31
20	120.3	256.2	48.488	125.932	5.3		118.3	7.0	118.3	4.7	9.3	95.0	4.9		200.0	1.69
22	143.0	178.0	48.660	126.142	5.5		146.1	6.8	145.0	4.6	10.5	143.0	4.5		250.0	1.71
23	156.0	320.7	48.648	126.164	5.0	38.7	151.1	6.7	157.5	5.0	10.8	155.5	4.0		300.0	1.99
24	171.0	306.5	48.754	126.264	6.0	40.0	173.9	6.6	172.3	5.1	10.9	172.3	2.9		375.0	2.16
26	231.3	307.0	48.786	126.353	5.7		240.4	6.6	241.3	3.9	10.3	242.7	3.7		450.0	1.87
27	171.3	331.2	48.832	126.365	6.0		175.6	6.6	174.0	4.7	10.3	172.3	4.7		350.0	1.99
28	269.0	267.0	48.782	126.461	4.2		276.2	6.3	272.0	5.0	10.3	272.3	5.1	9.0	456.0	1.65
29	444.0	319.0	48.750	126.511	4.8		436.7	5.4	435.0	3.6	10.7	438.3	3.5		800.0	1.83
30	219.0	344.0	48.829	126.526	4.8		228.1	6.4				226.3	4.2		475.0	2.08
31	86.7	340.7	49.008	126.215	5.8	34.3	89.3	7.5	88.3	4.4	10.5	86.0	4.3		200.0	2.24
32	132.0	339.6	48.885	126.276	5.7	14.5	134.5	6.9	132.7	4.8	10.2					
33	150.0	317.0	48.933	126.411	5.0	34.5	154.1	6.7	152.0	4.0	10.9	151.3	3.8		300.0	1.95

Appendix 5: Continued.

	Sounder	GPS				BCS	SBE 39		Furuno FS20			Simrad ITI			Main Warp Scope	
Set	Bottom Depth (m)	Direction	Latitude	Longitude	Speed (km/h)	Tilt Angle	Depth (m)	Temp (C)	Trawl Depth (m)	Trawl Height (m)	Trawl Width (m)	Trawl Depth (m)	Trawl Height (m)	Trawl Width (m)	Length (m)	Ratio
34	151.0	321.0	48.954	126.448	4.6	36.0	156.1	6.7	153.3	4.6	10.9	152.7	4.3		300.0	1.92
35	450.3	346.0	48.971	126.640	4.2		552.2	5.1	566.0	5.5	10.7	575.3	6.8		1016.7	1.84
36	243.3	285.4	48.998	126.715	5.3	31.2	249.0	6.0	246.3	4.9	10.2	245.3	4.7		475.0	1.91
37	275.0	306.9	49.041	126.833	5.1	23.5	282.1	6.2	278.7	3.9	10.4	277.3	3.6		625.0	2.22
38	329.7	333.0	49.074	126.898	4.9	29.9	344.6	5.6	342.0	4.6	10.2	343.7	4.4		750.0	2.18
39	139.3		49.064	126.655		24.0	143.4	6.7	142.0	4.0	10.6	140.7	3.8		325.0	2.27
40	134.3		49.095	126.655		24.1	137.7	6.9	136.0	4.4	10.9	135.0	3.9		325.0	2.36
41	142.3		49.207	126.830		33.1	144.8	6.9	144.3	4.1	10.5	143.0	3.5		350.0	2.42
42	188.0		49.223	126.977		34.9	192.6	6.4	191.0	3.9	10.4	191.3	3.5		450.0	2.34
43	215.3		49.226	127.032		31.1	223.1	6.3	221.3	4.8	10.4	222.7	4.8		425.0	1.90
44	182.7		49.247	127.032		24.3	187.4	6.7	186.0	4.6	10.9	183.3	3.9		450.0	2.40
45	203.3		49.317	127.160		34.2	216.8	6.5	212.0	4.4	9.7	214.7	3.8		475.0	2.19
46	184.7		49.368	127.194		35.5	190.4	6.7	189.0	4.4	10.1	187.3	4.2		425.0	2.23
47	218.0		49.429	127.239		40.8	221.7	6.6	223.7	4.9	10.5	225.0	4.4		475.0	2.14
49	63.3		49.470	126.808		32.0		0.0	63.0	5.0	10.6	62.0	4.2	14.3	175.0	
50	124.7		49.377	126.887				0.0	126.0	4.4	10.4	125.0	3.9	14.0	275.0	
51	129.7		49.321	126.859		30.8		0.0	131.0	5.0	11.8	130.7	4.3	16.7	375.0	
52	115.0		49.341	126.811		28.5		0.0	116.0	4.4	11.0	115.0	4.0	15.0	400.0	
53	89.3		49.335	126.671		25.4		0.0	89.3	5.3	10.0	88.3	4.6	14.3	225.0	
54	72.3		49.205	126.387		34.0		0.0	72.5	5.1	10.1	71.3	4.4	14.3	175.0	
56	59.0	324.6	49.093	126.171	6.3	10.3	60.1	8.3	59.0	5.3	9.4				150.0	2.49
57	53.5	157.0	49.104	126.121	4.9	10.0	53.3	8.5	52.5	5.4	9.9				150.0	2.82
58	54.0	169.0	49.099	126.109	4.5	10.6	54.1	8.5	53.0	5.4	10.5				150.0	2.77
59	64.5	163.7	49.033	126.128	4.7	11.1	64.9	8.3	64.3	5.6	11.1				150.0	2.31
60	179.4	161.2	50.077	128.000	4.8		178.9	6.6	176.0	5.3	8.3	174.6	5.6	11.0	420.0	2.35
61	189.5	157.0	50.146	128.071	5.1	34.2	177.2	6.6	175.8	4.1	10.2	173.0	4.3	15.3	300.0	1.69
62	202.8	93.7	50.361	128.335	5.7	43.3	210.7	6.4	206.0	4.4	9.9	206.0	4.2	13.5	425.0	2.02
63	358.5	328.0	50.359	128.441	4.8	45.4	362.9	5.7	354.3	4.8	10.5	350.5	4.6	14.7	625.0	1.72
64	159.0	143.5	50.534	128.405	5.5	31.6	163.3	6.7	160.3	4.4	10.1	159.8	4.6	13.3	325.0	1.99
69	59.0	201.3	49.925	127.429	5.5			11.7								
70	63.5	222.0	49.920	127.521	5.2			11.8								

Appendix 5: Continued.

	Sounder	GPS				BCS	SBE 39		Furuno FS20			Simrad ITI			Main Warp Scope	
Set	Bottom Depth (m)	Direction	Latitude	Longitude	Speed (km/h)	Tilt Angle	Depth (m)	Temp (C)	Trawl Depth (m)	Trawl Height (m)	Trawl Width (m)	Trawl Depth (m)	Trawl Height (m)	Trawl Width (m)	Length (m)	Ratio
71		131.3	49.894	127.501	5.7			12.2								
72	61.0	118.8	49.897	127.370	4.9	10.3		12.2				57.7	4.0		200.0	
75	113.0	192.7	49.649	127.149	5.2	7.7		0.0				113.0	3.0		275.0	
76	135.0	304.0	49.681	127.312	4.8	18.3		0.0	133.8	5.0	10.5	129.5	4.6		350.0	
77	149.8	121.0	49.591	127.278	5.1	14.7		0.0	149.6	5.1	11.4	148.4	4.7	14.8	350.0	
79	230.8	148.0	49.357	127.217	4.8	17.2		0.0	233.3	4.8	9.6	255.8		14.5	525.0	
80	336.2	136.0	49.333	127.206	4.5	15.6		0.0	375.8	5.0	10.1	377.4		14.6	700.0	
81	247.4	327.0	49.330	127.190	5.2	13.9		0.0	257.4	4.7	10.2	258.2	4.4	15.6	550.0	
82	121.5	114.8	49.435	126.964	5.1	15.0		0.0	122.8	5.0	10.0	121.8	4.4	14.8	300.0	
83	137.6	158.5	49.381	126.959	5.2	23.2		0.0	138.0	5.0	11.1	136.6	4.6	15.8	350.0	
84	345.8	187.0	48.480	126.180	4.8	13.1	312.6	5.9	315.4	4.6	10.2	313.2	4.3	16.6		
85	147.6	330.2	48.618	126.130	5.6	12.5	152.7	6.8	149.8	4.7	9.7	148.6	4.4	14.2	325.0	2.13
86	106.5	305.3	48.571	126.006	5.3	22.1	111.3	7.2	129.0	5.6	10.7	108.0	5.1	15.0	275.0	2.47
87	65.0	322.5	48.557	125.628	5.5	20.5	67.5	7.8	66.3	4.5	9.5	64.3	4.2	15.0	175.0	2.59
88	173.7	73.1	48.672	125.526	5.8	23.6	177.9	7.7	180.0	5.5	8.6	176.3	5.2	15.0	425.0	2.39
89	136.3	128.6	48.701	125.492	5.4	20.9	136.0	7.9	255.3	4.5	8.1	132.3	4.6	15.5	425.0	3.13
90	177.3	246.4	48.729	125.581	5.0	21.5	176.9	7.8	297.0		7.9	175.5	4.5	15.3	400.0	2.26
92	102.3	311.4	48.851	125.494	5.7	17.3	103.3	8.1	101.3	5.2	10.5	99.8	4.7	14.8	225.0	2.18
93	81.5	265.4	48.908	125.676	5.3	14.2	83.7	8.6	81.8	5.2	9.8	80.3	5.2	14.8	200.0	2.39
94	96.0	36.0	48.922	125.702	4.7	12.2	98.0	8.3	96.6	5.5	9.9	95.3	4.8	15.0	200.0	2.04
95	53.0	238.1	48.815	125.582	5.7	17.3	53.5	8.4	51.8	5.0	9.8	49.3	4.4		150.0	2.80
96	71.3	255.9	48.643	125.429	5.0	19.0	72.0	7.5	70.3	5.2	10.6	69.0	4.8	14.3	200.0	2.78
97	123.0	118.0	48.600	125.387	5.1	22.0	124.8	7.2	123.7	4.9	10.4	121.7	4.5	15.0	200.0	1.60
99	84.0	170.5	48.558	125.405	5.2	15.7	86.3	7.2				84.3	4.7		250.0	2.90
100	130.0	200.2	48.521	125.368	5.5	21.8	138.9	6.9				132.0	4.7	15.0	375.0	2.70
101	148.0	74.8	48.483	125.385	5.6	27.4	150.6	6.8				148.5	5.1	15.0	375.0	2.49
102	100.0	88.2	48.494	125.613	5.1	14.9	100.4	7.6	99.3	5.3	10.4	96.3	4.7	14.8	275.0	2.74
103	131.5	140.0	48.393	125.532	5.3	10.8	133.4	6.9	131.5	5.2	10.4	129.8	4.6	15.3	375.0	2.81
104	117.8	8.1	48.372	125.362	5.2	13.4	120.9	6.9	119.3	5.6	10.6	118.3	4.8	14.5	300.0	2.48
105	161.8	47.0	48.423	125.341	5.3		164.0	6.9	162.2	4.8	10.7	161.2	4.4	14.8	400.0	2.44